A CLINICAL STUDY OF MULTI-NODULAR GOITER-A PROPECTIVE STUDY

Dissertation submitted to

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In partial fulfilment of the degree of

M.S. GENERAL SURGERY

Branch -1

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DEPARTMENT OF GENERAL SURGERY
APRIL 2014

CERTIFICATE

This is to certify that this dissertation entitled **"A CLINICAL STUDY OF MULTI-NODULAR GOITER-A PROPECTIVE STUDY"** is a record of bonafide research work done by Dr.S.Balamurugan, under my guidance and supervision in the Department of General Surgery, PSG Institute of Medical Sciences and Research, Coimbatore – 641004.

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This is to certify that the dissertation entitled **"A CLINICAL STUDY IN MULTI-NODULAR GOITER - A PROSPECTIVE STUDY"** is a bonafide work done by Dr.S.BALAMURUGAN inpartial fulfillment of the requirement for the degree of M.S. in General Surgery under my guidance.

Date: 28.12.2013

Place: Coimbatore

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DECLARATION

I, Dr.S.Balamurugan, solemnly declare that this dissertation **"A CLINICAL STUDY OF MULTI-NODULAR GOITER-A PROPECTIVE STUDY"** is a bonafide record of work done by me in the Department of General Surgery, PSG institute of Medical Sciences & Research, Coimbatore, under the guidance of **Dr.T.S.Balashanmugam**, Professor of Surgery.

This dissertation is submitted to The Tamilnadu **Dr.M.G.R.Medical University, Chennai,** in partial fulfilment of the University regulations for the award of MS Degree (General Surgery) Branch-I, Examination to be held in April 2014.

Place : Coimbatore

Date : 27th December, 2013 **(S.BALAMURUGAN)**

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LIST OF ABBREVATIONS USED

MNG	Multi nodular goiter
FNAC	Fine needle aspiration cytology
T3	Tri iodo thyronine
T4	Thyroxine
TSH	Thyroid stimulating hormone
TRH	Thyrotropin releasing hormone
MIT	Mono iodo tyrosine
DIT	Di iodo tyrosine
WHO	World health organization
TBG	Thyroxine binding globulin
PBI	Protein bound iodine
FTI	Free thyroxine index
USG	Ultrasonography
STT	Sub total thyroidectomy
NTT	Near total thyroidectomy
HT	Hemithyroidectomy
RLN	Recurrent laryngeal nerve

ABSTRACT

Objectives:

1. To enrich the existing information in the field of thyroid diseases.
2. To study the various modes of presentation, the distribution with respect to age and sex, the usefulness of FNAC, and the complications of surgery.
3. To review the mode of treatment.

Background Data:

Multi-nodular goiter is a commonly used term describing an enlarged thyroid gland with multiple areas of nodularity.

Worldwide where MNG is the most common endocrine disorder affecting 500-600 million people.

Nodular goitre remains a problem of enormous magnitude affecting no less than 5% of the population. Where iron deficiency is the culprit.

Methods and materials:

The present study of "clinical study and management of multinodular goiter" has been conducted by utilizing the cases diagnosed clinically as MNG and treated on inpatient basis in the department of General Surgery at PSG hospitals Coimbatore. It is a prospective study of all the cases clinically diagnosed as MNG of about 30 cases.

Result: Majority of the patients were females with a F : M ratio of 14:1,with the commonest age group being 41- 50 yrs. All patients presented with swelling in front of the neck, with other complaints being that of pain, discomfort, and features of hyperthyroidism in 1 patient. FNAC was done in all patients and was found to be 91% accurate. Majority of the patients were treated with Total Thyroidectomy followed by Subtotal Thyroidectomy. Complications included hypocalcemia and RLN palsy.

CONTENTS

INTRODUCTION

Though the thyroid and its diseases were known to the physicians from the time immemorial, the subject still continues to evince great interest even today from the clinician and the pathologist alike. As Willis stated, for the thyroid gland, working in continuous state of interest having alternate periods of cellular activity and quittance in response to an array of exogenous and endogenous stimuli, it is not so surprising that it suffers from a wide variety of disease. A constant supply of thyroid hormones is necessary for growth, development and maintenance of metabolism and functional activity of most organs. Diseases of thyroid are manifested either qualitative and quantitative alterations in hormone secretion or enlargement of thyroid (goitre) or both.

The gland is slightly heavier in the female sex and enlarges during pregnancy and menstruation. [1]

Nodular goitre is probably the most common endocrine problem in the world today. [2]

GOITRE:

Worldwide, nodular goitre remains a problem of enormous magnitude. It is estimated that no less than 5% of the world's population have goitres. Depending on the populat ion studies, multinodular goitre occurs in upto 12% of adults. Multinodular goitre is more common in women than men and

increases in prevalence with age. The incidence of carcinoma in multinodular goitre has been reported as 5% to 10%.[4]

Neither a well formulated nor a simple procedure is available for the management of patients with MNG. The main reason for such situation to exist is, nodular lesions may represent one of the many different cell types that cannot be distinguished from one another without histologic study. [5]

These nodules may be benign or malignant. Ultimately, it is this threat of malignancy that poses a major problem.

FNAC is a diagnostic tool in which cells are extracted from the palpable swelling. Post- operative respiratory complications may need either life saving endotracheal intubation followed by tracheostomy or immediate tracheostomy.

Objectives:

1. To enrich the existing information in the field of thyroid diseases.
2. To study the various modes of presentation, the distribution with respect to age and sex, the usefulness of FNAC, and the complications of surgery.
3. To know the principles and management of MNG.
4. To review the mode of treatment adopted and to compare and correlate the findings of investigations with the final histopathology report of the resected specimen.

REVIEW OF LITERATURE

A. HISTORICAL ASPECTS (7,8,9,10)

The thyroid gland was previously referred to as a laryngeal gland and was subsequently named thyroid by Wharton in 1645, because of thyroid cartilage with which it is closed associated.

Thyroxine (T4) was isolated by Kendall in 1965 and it was synthesized by the Harrington and Banger in 1927. In 1953 the important discovery of 3, 5, 3 Tri-iodothyronine was made by Cross and Pitt-rivers and by Roche, Liesitsky and Michel simultaneously. This was proved to be more effective than thyroxine itself.

Early operations:

The first credible account of thyroid surgery was given in 1170, by Roger Frugardi of Salerno, in the Bamberg manuscripts.

By the 19^{th} century the usual indications for surgery were suffocationand dysphagia. The overall mortality was over 40% and many surgeons advised against operating on goiters and considered it as one of the most thankless, most perilousundertakings.

The leading thyroid surgeons at this time were Theodor Kocher (1841-1917) and Theodor Billroth (1829-1894). Both of them performed thousands of thyroidectomies, with progressively better results.

Theodor Kocher was Professor of Surgery in Berne, Switzerland. Kocher advocated gentle meticulous surgery that spared yet to be discovered parathyroid glands and anatomical appreciation of recurrent laryngeal nerve. With application of these principles mortality of thyroid surgery decreased from more than 59% to approximately 0.2%. Even more important was the discovery by Kocher that total thyroidectomy was followed by development of myxoedema and he demonstrated that this complication could be prevented by subtotal thyroidectomy. Kocher was awarded Nobel Prize in 1909.

Since 1970, FNAC as promoted by Perola Granger of Stockholm has contributed greatly in early diagnosis of carcinoma.

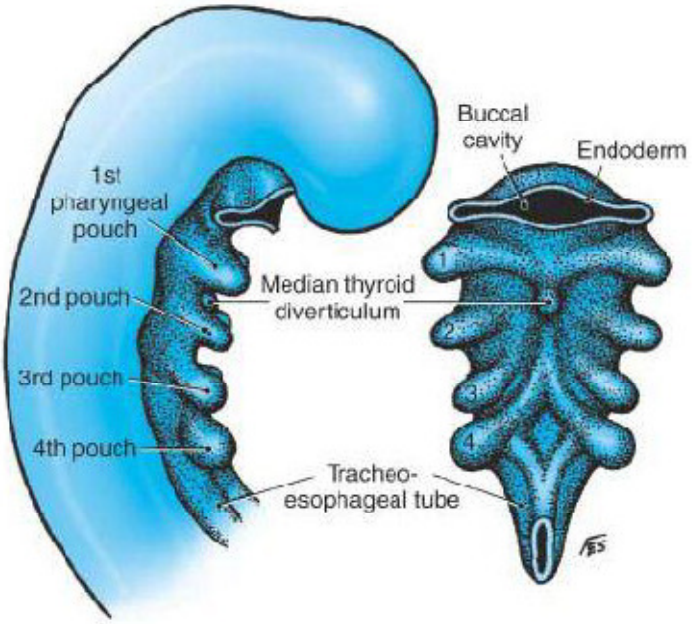
With the development of techniques such as FNAC and ultrasound, the performance of thyroidectomy has become selective, unlike in the past when surgery was recommended for nearly all Multinodular goitres.

DEVELOPMENT OF THYROID GLAND (11)

The thyroid gland develops from the epithelial cells in the midline of the floor of the pharynx at the level of first pharyngeal pouch. As the thickening develops, a process of enfolding takes place. This diverticulum becomes an elongated sack attached to the floor of pharyngeal pouch known as thyroglossal duct and connects the primitive thyroid structure to the base of the tongue, which is being formed at thesame time. The origin of diverticulum is marked by foramen caecum.

During 6^{th} week of embryonic life, the diverticular thyroid structure becomes bilobar and descends to its ultimate position with a lobe on either side of trachea in the neck, later these lobes are connected by isthmus. At the same time, normally the thyroglossal duct disappears. The ultimo bronchial body and internal epithelial body, which are derivatives of forth pharyngeal pouch migrate downward and become associated with thyroid. The parafollicular C cells are derived from ultimo branchial body.

By 8th week of embryonic development, small cavities appear in the thyroid tissue. They expand and proliferate, as colloid appears in follicles. Formation of follicles is completed by fifth month of fetal life, thereafter the new follicles are formed by budding and division of existing follicles. Thyroid is the earliest glandular structure to appear. It becomes functional during the third month of development of fetus.



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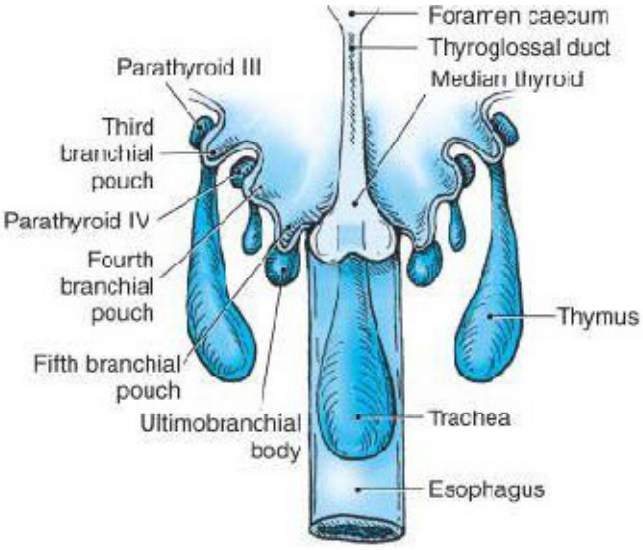


ANOMALIES OF THE THYROID GLAND [12]

A. Anomalies of shape:

i. The pyramidal lobe is present so often that it is regarded as a normal structure. It may arise from the isthmus or from one of the lobes.

ii. The isthmus may be absent.

iii. One of the lobes of the gland may be very small, or absent.

B.Anomalies of position

i. Lingual thyroid: The thyroid may be under the mucosa of the dorsum of the tongue and .

ii. Intra- lingual thyroid: The thyroid may be embedded in the muscular substance of tongue.

iii. Suprahyoid thyroid: The gland may lie in the midline of the neck above the hyoid bone.

iv. Infrahyoid thyroid: The gland may lie below the hyoid bone, but above its normal position.

v. Intrathoracic thyroid: The entire gland, or part of it, may lie in the thorax.

C. ***Ectopic thyroid tissue:*** Small masses of thyroid tissue have been observed in the larynx, trachea, oesophagus, Pons, pleura, pericardium and ovaries. Masses of ectopic thyroid tissue have been described in relation to the deep cervical lymph nodes (lateral aberrant thyroids) but these are now believed to represent metastases in the lymph nodes from a carcinoma of the thyroid gland.

D.Remnants of the thyroglossal duct may persist and lead to the formation of:

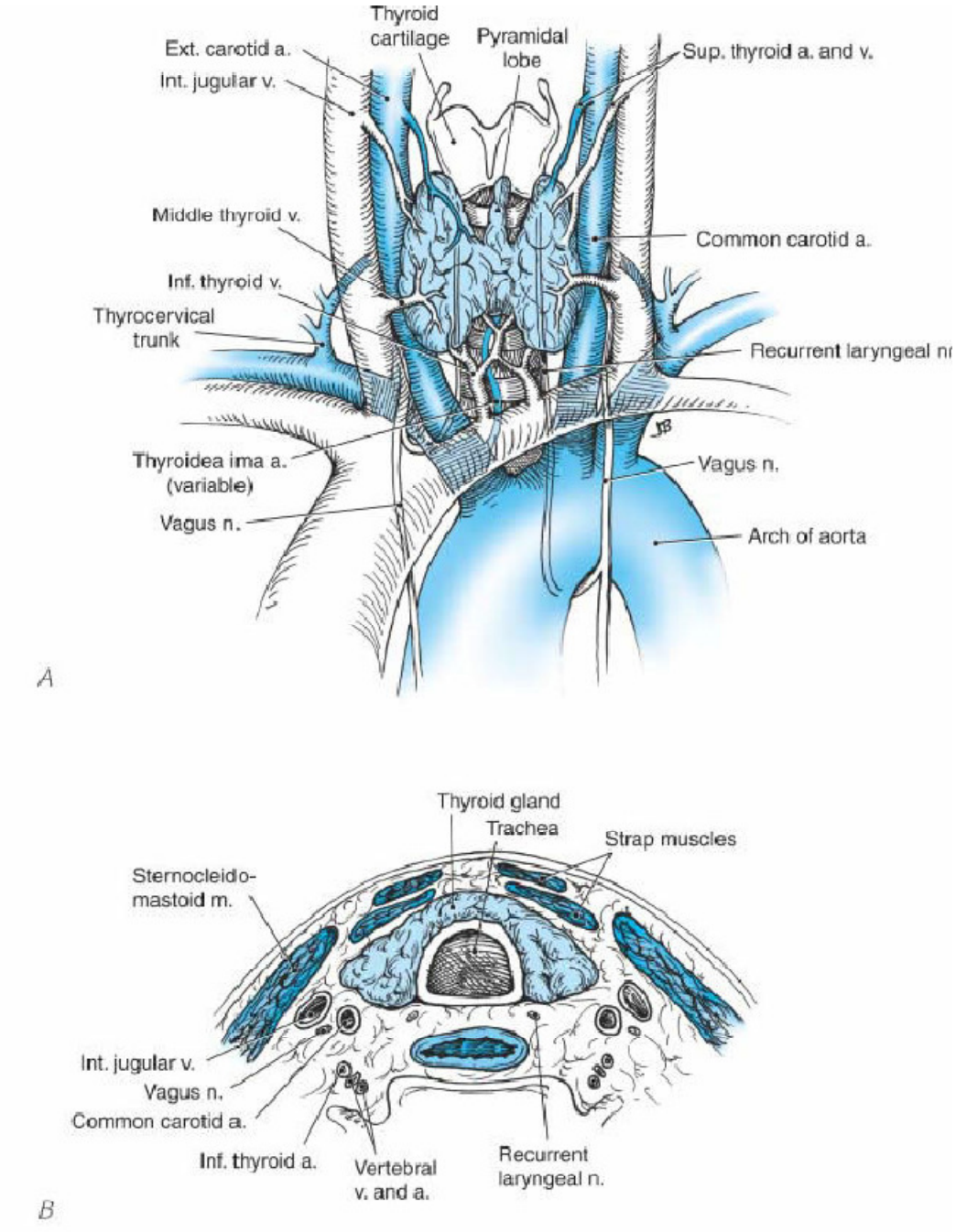
a. Thyroglossal cysts that may occur anywhere along the course of the duct.

b. Thyroglossal fistula opening at the foramen caecum. c. Carcinoma of the thyroglossal duct.

SURGICAL ANATOMY OF THYROID GLAND13,14,15,16,17

Thyroid gland averagely weighs 20-25 Gms. It is larger in females than in males and increases further during pregnancy and menstruation. The thyroid gland occupies the important position in the central compartment of the neck, . The thyroid gland has two lobes connected by isthmus. Each lobe is pear shaped consists of narrow upper pole and broader lower pole. The lobes occupy the anterolateral surface of trachea extending from the middle of thyroid cartilage superiorly up to 6th tracheal ring inferiorly. The right lobe is larger than the left. The isthmus lies in the front of 2nd and 3rd tracheal rings and attached quite firmly to trachea. The gland possesses its own delicate capsule and fascia propria. It lies within the envelope of pretracheal fascia. The superficial surface of the gland is covered by the infrahyiod and sternomastoid muscles with its fascial coverings. The medial surface is related to the trachea and esophagus, two nerves recurrent and external laryngeal nerves, two muscles inferior constrictor and Cricothyroid.

The posterior surface overlaps the common carotid artery and covers the terminal part of inferior thyroid artery. Isthmus joins the anterior surface of lobes towards their lower poles.. A small portion of the gland projects upward from the upper border of isthmus, named as pyramidal lobe. It represents the distal most part of the thyroglossal duct. Sometimes few muscle fibers are attached to it, called levator glandulae thyroidea and it is innervated by external laryngeal nerve.



Anatomy of the thyroid gland and surrounding structures, viewed anteriorly (A) and in cross section (B).

BLOOD SUPPLY

The thyroid gland is supplied by a pair of superior thyroid arteries, inferior thyroid arteries, and solitary thyroidea-ima artery and accessory thyroid arteries.

a. **Superior thyroid artery:** It is the first branch from the anterior surface of the external carotid artery. After giving off sternomastoid and superior laryngeal branches, it pierces the pretracheal fascia as a single branch and reaches the tip of the upper pole and enters the gland superficially.
b. **Inferior thyroid artery:** It is a branch of thyrocervical trunk which arises from the first part of the subclavian artery. In the neck, it passes behind the carotid artery. Before entering the pretracheal fascia, it divides into 4 or 5 branches that pierce the fascia separately to reach the lower pole of the gland.
c. **Thyroidea ima artery:** It enters the lower part of the isthmus in 3% of the individuals. It arises from the arch of aorta or innominate artery.

VEINS

The thyroid gland is drained by following veins

a. **Superior thyroid vein:** It leaves the upper part of the gland, crosses the common carotid artery and terminates into the internal jugular vein or common facial vein.

b. **Middle thyroid vein:** It leaves the gland at the middle of the lateral part of the lobe, follows the inner border of the omohyoid muscle across the carotid vessels to end in internal jugular vein. It is thick, short and directly enters the jugular vein. It is present only in 30% of individuals.

c. **Inferior thyroid vein:** It leaves the Isthmus at the inferior border and runs down in front of the trachea to end in innominate vein of the same side.

d. **Fourth thyroid vein**: KOCHER drew attention to the frequent existence of this vein which passes outward between middle and inferior thyroid vein.

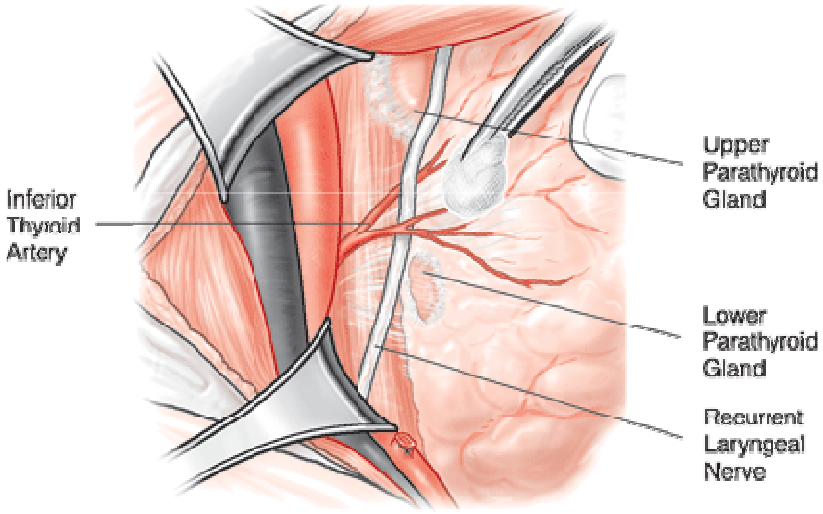
NERVES RELATED TO THE GLAND

The external laryngeal nerve and the recurrent laryngeal nerve are in close relationship with the gland.

a. **External laryngeal nerve:** It is a branch of superior laryngeal nerve, descends on the fascia of the inferior pharyngeal constrictor to supply the cricothyroid muscle which is tensor of vocal cords. The nerve lies close to the superior pedicle with nerve medial, vein lateral and superior thyroid artery between them. Injury to external laryngeal nerve results in decrease range of pitch and fatigue in speaking. It may or may not cause change in voice. Laryngoscopy reveals normal

movement of vocal cord but it is irregular and wavy and the cord lies at the lower level and has lack of the tone resulting in bulge on expiration and retraction on inspiration.

b. **Recurrent laryngeal nerve:** The nerve is branch of vagus nerve embryologically related to 4th aortic arch vessels. The nerve lies in the tracheo-oesophagal groove and posterior to the inferior thyroid artery. The nerve may be lateral (28%) or anterolateral (10%) to trachea. In 30% of cases, it passes anterior to inferior thyroid artery or may even lie within its branches.



Relationship of the parathyroids to the Recurrent Laryngeal Nerve

In some cases, the nerve will be embedded in the ligament of berry and thus it will be drawn forward with the gland traction. Injury to this nerve results in partial (abductor) or total paralysis of the cord resulting in hoarseness and respiratory difficulty.

Non-recurrent laryngeal nerve: In 0.63% cases the recurrent laryngeal nerve may not recur. The recurrent laryngeal nerve arises from the vagus nerve in the neck in the proximity to the 4th primitive aortic arch vessels which form the subclavian artery on the right side and aortic arch on the left side. The recurrent laryngeal nerve passes caudal these vessels to larynx and is therefore dragged caudally when vessels descend. The non-recurrent laryngeal nerve may be mistaken for inferior thyroid artery or middle thyroid vein and ligated during thyroidectomy.

c. **Internal laryngeal nerve:** It is the branch of the superior laryngeal nerve and penetrates the larynx through thyrohyoid membrane. Injury to this nerve is exceptional and occurs only when the superior pole is very much enlarged. It results in loss of sensation of laryngeal inlet with post deglutition coughing, chocking, or aspiration pneumonia.

CAPSULES:

The thyroid gland is surrounded by two capsules, the true capsule and a false capsule. The true capsule is made up of condensation of connective tissues around the gland while the false capsule is formed by pre-tracheal

fascia. The blood vessels pierce both these capsules and thus firmly ramify to form a dense vascular plexus beneath the inner or true capsule of the gland. The space between the two capsules is traversed by the arterial and venous trunks. During operations on thyroid utmost care is taken not to injure the true capsule as under it lays the numerous fragile vessels.

SUSPENSORY LIGAMENT OF BERRY:

This is the thickening of pre-tracheofascial investment of thyroid. It passes from inner and posterior surface of the gland to cricoid cartilage. The two ligaments left and right form a sling, anchoring the gland to the larynx. They increase in size in large goitres, thus preventing the gland falling away from larynx. The recurrent laryngeal nerve is in immediate contact with the back of the ligament.

LYMPHATICS OF THYROID:

The gland is drained by two sets of lymphatics

1) ascending and 2) descending each consisting of medial and lateral channels.

Ascending Vessels:

Medial: leave the upper border of the gland and drain into nodes situated on the cricothyroid membrane, the prelaryngeal gland.

Lateral: leave the upper pole of the gland and run along the superior thyroid artery to the deep cervical nodes situated at the bifurcation of common carotid artery.

Descending Vessels:

Medial: pass to the gland on the trachea, pre-tracheal lymph nodes.

Lateral: pass from the deep surface of the gland to small nodes placed on recurrent nerve, the nodes of recurrent chain.

The lymph vessels run in the interlobular connective tissue and connect with the network within the capsule of the gland. The ascending lymphatic channels drain the upper border of isthmus and surface of the lobes. The descending channels drain the major part of isthmus and lower part of lateral lobes. The median lymph node near the isthmus is often involved in thyroid cancer, which is called *Delphian* node.

NERVE SUPPLY OF THE GLAND

The bulk of the sympathetic supply is derived from the middle cervical ganglion and enters the gland on the inferior thyroid artery. Some fibers from the superior ganglions travel with the superior thyroid artery. The sympathetic fibers are vaso-constrictor. Vagus nerve also supplies the gland. Its purpose is unknown.

MICROSCOPIC ANATOMY

A section of the gland shows the typical colloid follicles, whose appearance depend on the state of activity of the gland. In resting stage follicles are uniformly distended with colloid, they are rounded in outline and lined by low columnar epithelium. These follicles are arranged in subunits of 20 to 40 lobules each being supplied by an individual arteriole. These cells secrete thyroxin (T4) and triiodothyronine (T3). Clumps of small round cells lie between the follicles, which are parafollicular cells, which produce calcitonin. In more active state the colloid is less and follicles are uniformly smaller and crinkled in outline. The lining columnar epithelium is much taller.

PHYSIOLOGY [18]

The thyroid gland maintains the level of metabolism in the tissues that is optimal for their normal function. Thyroid hormones stimulate the 0 2 consumption of most of the cells in the body, help regulate lipid and carbohydrate metabolism, and are necessary for normal growth and maturation. The thyroid gland is not essential for life, but its absence causes mental and physical slowing, poor resistance to cold, and, in children, mental retardation and dwarfism. Conversely, excess thyroid secretion leads to body wasting, nervo usness, tachycardia, tremor, and excess heat production. The thyroid gland also secretes calcitonin, a calcium- lowering hormone.

FORMATION AND SECRETION OF THYROID HORMONES

The principal hormones secreted by the thyroid are thyroxine (T4) and triiodothyronine (T3), T3 is also formed in the peripheral tissues by deiodination of T4. Both hormones are iodine - containing amino acids. Small amounts of reverse triiodothyronine (3, 3', 5'- triiodothyronine. RT3) and other compounds are also found in thyroid venous blood. T3 is more active than T4. The naturally occurring forms of T4 and its congeners with an asymmetric carbon atom are the L isomers. D- Thyroxine has only a small fraction of the activity of the L form. T4 and T3 are synthesized in the colloid by iodinat ion and condensation of tyrosine molecules bound in peptide linkage in thyroglobulin. This glycoprotein is made up of two sub - units and has a molecular weight of 6, 60,000. Thyroglobulin is synthesized in the thyroid cells and secreted into the colloid. The hormones remain bound to thyroglobulin until secreted. When they are secreted, colloid is ingested by the thyroid cells, the peptide bonds are hydrolyzed, and free T4 and T3 are discharged into the capillaries. Thyroglobulin enters the blood as well as the colloid. The normal serum thyroglobulin concentration in humans is about 6ng/mL, and this level is increased in hyperthyroidism and some forms of thyroid cancer.

Iodine Metabolism: Iodine is a raw material essential for thyroid hormone synthesis. Ingested iodine is converted to iodide and absorbed. The

principal organs that take up the iodine are the thyroid, which use it to make thyroid hormones, and the kidneys, which excrete it in the urine.

Iodide Trapping: The thyroid concentrates iodide by actively transporting it from the circulation to the colloid. The transport mechanism is frequently called the "iodide trapping mechanism" or "iodide pump". In the gland, iodide is rapidly oxidized and bound to tyrosine.

Thyroid Hormone Synthesis: In the thyroid gland, iodide is oxidized to iodine and bound in a matter of seconds to the 3 position of tyrosine molecules attached to thyroglobulin. The enzyme responsible for the oxidation and binding of iodide is *thyroid peroxidase,* with hydrogen peroxide accepting the electrons. Monoiodotyrosine (MIT) is next iodinated in the 5 position to form diiodotyrosine (DIT). Two DIT molecules then undergo an oxidative condensation to form T4 with the elimination of the alanine side chain from the molecule that forms the outer ring. Thyroid peroxidase is probably involved in coupling as well as iodination. T3 is probably formed by condensation of MIT with DIT.*Secretion:* The human thyroid secretes about 80 μg (103 nmol) of T4, 4 μ*g* (7nmol) of T3. However, MIT and DIT are not secreted.

TRANSPORT AND METABOLISM OF THYROID HORMONES

Protein Binding: The normal total *plasma T4* level is approximately 80 μg (103nmol/L), and the *plasma* T3 level is approximately 4 μ*g* (7nmol/L).

Large amounts of both are bound to plasma proteins. The normal *Protein-bound iodine is* potent than T4. This is because it is less tightly bound to plasma proteins but binds more avidly to thyroid hormone receptors T3 is inert.

1. ***Calorigenic Action:*** T4 and T3 increase the oxygen consumption of almost all metabolically active tissues. The exceptions are the adult brain, testes, uterus, lymph nodes, spleen, and anterior pitutary.
2. ***Effects Secondary to Calorigenesis:*** In hypothyroid children, small doses of thyroid hormones cause a positive nitrogen balance because they stimulate growth, but large doses cause protein catabolism similar to that produced in the adult. Peripheral resistance decreases because of cutaneous vasodilation, but cardiac output is increased by the combined action of thyroid hormones and catecholamines on the heart, so that pulse pressure and cardiac rate are increased and circulation time is shortened.
3. ***Effects on the Nervous System:*** In hypothyroidism, mentation is slow and the CSF protein level elevated. Thyroid hormones reverse these changes, and large doses cause rapid mentation, irritability and restlessness.
4. ***Effects on the Heart:*** Thyroid hormones increase the number and affinity of P - adrenergic receptors in the heart and consequently

increase its sensitivity to the inotropic and chronotropic effects of catecholamines.

5. ***Effects on Skeletal Muscle:*** Muscle weakness occurs in most patients with hyperthryoidism *(Thyrotoxic myopathy)* and when the hyperthyroidism is severe and prolonged, the myopathy may be severe. The muscle weakness may be due in part to increased protein catabolism.

6. ***Relation to Catecholamines:*** Thyroid hormones increase the number and affinity of p- adrenergic receptors in the heart and possibly in some other tissues, and the effects of thyroid hormones on the heart resemble those of p- adrenergic stimulation.

7. ***Effects on Carbohydrate Metabolism:*** Thyroid hormones increase the rate of absorption of carbohydrate from the gastrointestinal tract, an action that is probably independent of their calorigenic action.

8. ***Effects on Cholesterol Metabolism:*** Thyroid hormones lower circulating cholesterol levels.

9. ***Effects on Growth:*** Thyroid hormones are essential for normal growth and skeletal maturation. In hypothyroid children, bone growth is slowed and epiphyseal closure delayed. In the absence of thyroid hormones, growth hormone secretions are also depressed, and thyroid hormones potentiate the effect of growth hormone on the tissues.

REGULATION OF THYROID SECRETION

Thyroid function is regulated primarily by variations in the circulating level of pituitary TSH. TSH secretion is increased by the hypophysiotropic hormone TRH and inhibited in a negative feedback fashion by circulating free T4 and T3.

When TSH is administered, thyroid function is stimulated. Whenever TSH stimulation is prolonged, the thyroid becomes detectably enlarged. Enlargement of the thyroid is called goitre. The negative feedback effect of thyroid hormones on TSH secretion is exerted in part at the hypothalamic level, but it is also due in large part to an action on pituitary, since T4 and T3 block the increase in TSH secretion produced by TRH. Infusion of T4 as well as T3 reduces the circulating level of TSH, which declines measurably within one hour.

D. CLASSIFICATION OF GOITRE

Goitre is a clinical term for any visible or palpable enlargement of the thyroid gland.

Different authors have classified goitre in different ways

***I.Classification by Hamilton Bailey and McNeill Love** (19)*

1. Simple goitre (Euthyroid)

Diffuse hyperplastic

Physiological

Pubertal

Pregnancy

Multinodular goitre

2. Toxic

Diffuse

Graves disease

Multinodular goitre

Toxic adenoma

3. Neoplastic

Benign

Malignant

4. Inflammatory

Auto immune

Chronic lymphocytic thyroiditis

Hashimoto's disease

Granulomatous

deQuervain's thyroiditis

Fibrosing

Riedel's thyroiditis

Infective

Acute (Bacterial thyroiditis, viral thyroiditis, subacute thyroiditis)

Chronic (Tuberculous, syphilit ic)

5. Other

Amyloid

II. WHO Classification for endemic goitre: (20)

- Grade 0: Thyroid not palpable or, if palpable, not larger than normal.
- Grade la: Thyroid distinctly palpable but usually not visible in position; the thyroid is larger than normal, i.e. at least as large as the distal phalanx of the subject's thumb.
- Grade lb: Thyroid easily palpable and visible with the head in a
- raised position; the grade includes all patients with a discrete nodule.
- Grade 2: Thyroid easily visible with the head in a normal position.
- Grade 3: Goitre visible at a distance.
- Grade 4: Monstrous goitre.

III. SIMPLIFIED W.H.O GOITRE CLASSIFICATION SYSTEM (20)

GRADE 'O': No palpable or visible goitre.

GRADE '1': Mass in the neck is consistent with an enlarged thyroid that is palpable but not visible when neck is in neutral position, it also moves upward in the neck as the subject swallows.

GRADE '2': A swelling in the neck that is visible when the neck is normal position and is consistent with an enlarged thyroid when neck is palpated.

AETIOLOGY OF MULTINODULAR GOITRE21

The hormone synthesis and its release is regulated by TSH, which in turn is regulated by TRH. When the levels of T4 and T3 in the blood are low, anterior pituitary is stimulated to secrete TSH, which induces hyperplasia and hypertrophy of follicular cells to trap iodine and synthesize thyroid hormone. The hyperplasia may not occur uniformly, as a result of which some foci of hyperplasia are larger and other are small. Following hyperplasia, involution occurs as need for T4 and T3 decreases. Repeated stimulation causes hyperplasia and involution of varying degrees, also degenerative changes and fibrosis resulting in nodularity. Among various nodules only one of them attains large size and other will be of small size which cannot be detected clinically. The causes leading to deficiency of thyroid hormone synthesis are:

A) Iodine deficiency:

Iodine deficiency in endemic area results in highest incidence of goitre. Iodine deficiency alone does not cause goitre. There are other factors which play a role in aetiopathogenesis of goitre such as antithyroid agents. Concomitant exposure to naturally occurring antithyroid agents magnifies the severity of goiter endemicity. Iodine supplement is found to be associated with increased incidence of lymphocytic autoimmune thyroiditis.

B) Goitrogens :

Chemical goitrogens:

Anti thyroid compounds may enter through food, water, air becoming an important environmental goitrogenic factors in human being. They act as additive in endemic iodine deficient areas and responsible for sporadic goitre in nonendemic areas. Thiocyanate is also found in high concentration in water, effluent of local conversion process, and in body fluids as a metabolite of hydrocyanogenic gas consumed while smoking. Thiocyanate inhibits iodine concentration mechanism in thyroid gland and its activity can be overcome by iodine administration. Isothiocyanate acts by thiocyanate pathway and also react with amino groups forming derivatives having thiocyanate like antithyroid effect, therefore its activity cannot be antagonized by iodine administration. Flavinoids found in millets, sorghum, beans, groundnuts exert thiocyanate like antithyroid activity.

1. Phenol derivatives: Coal is the source of large variety of antithyroid agents and goitrogens like resorcinol, phenol, thiocyanate etc. Most of these compounds contaminate water.
2. Excess iodide: Iodine consumption in greater than 2mg/day inhibits proteolysis and release of thyroid hormones and induces iodide goitre.

Drugs that act as goitrogen:

Lithium,Para-amino salicylic acid (PAS), Phenendione, Phenyl butazone and Salfonamides.

C) **Genetic defects: Familal goitres**

Single gene abnormality causes defect in metabolic pathway of T4 synthesis, which are:

1. Defect in iodine transport
2. Defect in organification failure to form organic iodine
3. Deficiences of enzymes
4. Lack of iodine peroxidase – complete block
5. Lack of iodine transferase – incomplete block, relatively common
6. More than 150 cases reported with consistent association of goitre with deaf mutism. Pendred's syndrome is generally limited to single generation.
7. Coupling defect – Failure to couple iodotyrosines uncommon – 6 cases.

8. reported, more common in females.
9. Iodotyrosine deiodinase defect - uncommon.
10. Abnormal serum iodinated polypeptides – rare Autoimmune thyroid disease occur more often in Down's syndrome and also seen in Klienfelters syndrome.

D) **Immunological Factors:** The

Major antigens are TSH receptor (TSH-R), enzyme peroxidase, and thyroglobulin. TSH-R is major antigen in Grave's disease. TSH-R(stim) Antibodies tend to stimulate the cells. Antibodies to enzyme peroxidase and thyroglobulin are hallmark of Hashimoto's thyroiditis.

E) Calcium and Fluorine

The association of endemic goitres with lime stone formation in hard water was noted by many observers over the years leading to hypothesis that excessive ingestion of calcium is an aetiological factor. Some experimental evidence has been added to indicate that calcium may enhance the goitrogenic effect on the diet already deficient in iodine, though, how it acts is still a mystery.

F) Associated with malignancy

Radiation exposure to thyroid gland is only well documented risk factor that increases the incidence of well differentiated thyroid cancer.

There is 40% chance that patients presenting with a thyroid nodule and a history of radiation have thyroid cancer.

Classification of thyroid nodules

There is no universally accepted classification, as the etiology of the nodular goitre is presumptuous and pathological appearances are often difficult to correlate with clinical features (Alan Newton, 1950). Any classification must be workable and usable to clinician and pathologist and simple to avoid confusion, so admittable to change and revisions made by the newer concepts. (Warren and Meissner 1953).

Scintiscan classification of nodules

With Scintiscan it is possible to classify nodules into (Warren's classification):

- Hot nodules – hyper functioning
- Warm nodules – Functioning
- Cool nodules – Hypo functioning
- Cold nodules – Non functioning

This classification of nodules into four categories has difference of opinion. Meadow using this classification found carcinoma in one of the 77 hot (1-7%), one of 15 warm nodules (6.6%), 2 of 43 cool nodules (4.7%), and 14 of 24 cold nodules (58%).

Johnston, Beirwalter grouped cool and cold nodules together and found 14 cases of carcinoma in 32 cold nodules, one case of carcinoma in 10 warm nodules (10%) and no malignancy in hot nodules. Slatter and Pelnutter mentioned only two types of nodules, Hot and cold.

Pathogenesis of thyroid nodules

Thyroid nodules whether toxic, simple or malignant seem to arise as a result of thyroid follicles losing their dependence of thyroid stimulating hormone, a breakdown in the serve mechanism (Selwyn Taylor 1969). Selwyn Taylor suggested that the nodules in the nontoxic goitre are initially little foci of hyperthyroidism. He traced the origin of thyroid nodules back to the stage of simple hyperplasia. It is at this stage that the goitre is preventable.

Auto radiographic studies

This method of study consists of a slice of the thyroid gland exposed to a photographic film, which becomes black when the tissue contains radioactive material. Thus it makes possible for comparison of any area of thyroid with its capacity to concentrate and bind iodine to protein, in other words to synthesize thyroid hormones. By this study the evolution of the nodular goitre is divided into five stages (Selwyn Taylor Hypothesis).

Stage 1: The diffuse enlargement of thyroid gland, which shows increased vascularity a large uptake of radioiodine and with uniform blackening of auto radiograph. This is typical of puberty goitre but many persist for years.

Stage 2: Discrete focal areas of hyperplasia with corresponding blackening of autoradiograph. There are very few patients in whom all the functioning thyroid tissue is concentrated in a single area. Rawson described this very aptly as a toxic nodule in a nontoxic gland. Patient presents with erythroid state in this stage.

Stage 3: Lobules become increasingly hyperplastic and vascular. This stage is typified by disruption and haemorrhage. The blood supply in the nodules is carried by this walled tortuous dilated vessels, which bleed easily producing haemorrhagic necrosis by compression of surrounding tissue, fibrous pseudo capsule is formed around part of the nodule with obliteration of small vessel and formation of Arteriovenous shunt. These perinodular shunts also adversely affect blood supply of nodule. Therefore, bleeding and necrosis in the nodule is common.

Stage 4: Nodules undergo resolution in one or two ways, either a large, lace of colloid fills it and this is found to be free of iodine or mass of new follicles grow to supercede it and again their colloid does not take up radioiodine.

Stage 5: The Multinodular goitre is brought about by continued repetition of the process described above, with the result that most of nodules are inactive and incapable to metabolize iodine but among them are few active foci, which are currently supplying normal body requirement. In the hypothesis of Selwyn Taylor, the functioning nodule was a stage in the evolution of all nodular goitre is questioned by Scintiscan studies to determine the function of solitary or dominant thyroid nodule. It has been demonstrated in autonomous micro or macro nodules in the same thyroid gland suggesting that small nodules function in this manner form their origin. Auto radiographic studies with gross autonomous functioning nodule have demonstrated similar functioning micronodules.

Transition from functioning to non functioning nodule may occur through degenerative change or possibly by simple loss of functional capacity of follicles. Autonomous micronodules from the very early stage suggest partial loss of trophic control. The finding of functioning micronodule in the same gland with similar macro nodules strongly suggests that large nodules were functioning through the period of growth. High levels of monoiodotyrosine and diiodotyrosine are found in cold nodules and low in hot nodules.

Histopathology of Multinodular goitre22, 23, 24

The initial stage of nodular goitre is a simple goitre. With the passage of time due to repeated involution and hyperplasia, multiple nodules appear gradually. These nodules increase with advancing years. The thyroid acini are divided into three types depending upon the stage.

Resting stage: The acini are large, lined by flattened cells and filled with dense homogenous colloid.

Secretory Stage: Acini are lined by cuboidal epithelium and their colloid does not stain intensely.

Response Phase: Acini are lined by columnar cells and contain highly stained vacuolated colloid. As the simple goitre changes to nodular goitre the histological appearance vary according to the stage.

I. Stage of hyperplasia

It is due to increased TSH, which is secreted in response to low levels of circulating thyroid hormones.

Histology

Here the acini are hyperplastic and distorted by ingrowths and invagination of epithelium. The acini are lined by tall columnar cells. The colloid is less in amount. This phase will slowly change into colloid goitre.

II. Colloid Phase

It cannot be differentiated from hyperplastic gland clinically

Histology

Here the gland is a mixture of hyperplasia with colloid acini. The acini are lined by cuboidal cells. The concentration of iodine is less than normal gland. When the supply of iodine increases, the gland undergoes involution. Both hyperplastic and colloid goitre are associated with euthyroidism.

III. Nodular Phase

It is an irreversible stage of a simple goitre and is due to repeated stimulation of the gland. The process of hypertrophy, hyperplasia and involution follow repeatedly. Faulty areas of involution associated with colloid distension will compress the normal glandular tissue. This with newly formed fibrous tissue causes the nodule to become encapsulated. Macroscopically the nodules may be single or multiple. The nodules may be pale yellow pink and opaque in appearance. Dissolution of follicle lead to cyst formation and cyst may contain cholesterol crystals and colloid material.

Histology

Microscopically nodular goitre appears as colloid goitre. It consists of poorly defined fibrous capsule containing colloid filled acini, which are lined by low cuboidal epithelial cells.

Retrosternal goitre

Most retrosternal goitres arise from lower pole of a nodular goitre. Very few retrosternal goitre arise from ectopic thyroid tissue. If the neck is short and pretracheal muscles are strong in men, negative intrathoracic pressure tends to draw these nodules into superior mediastinum. Retrosternal goitre is often symptomless and is discovered on a routine chest radiograph. It receives its blood supply from inferior thyroid vessels.

Retrosternal goitre may be:

1. Substernal – commonest type, lower border of thyroid is behind the sternum.
2. Intrathoracic – No thyroid is seen in the neck. Diagnosis is by radioiodine scan.
3. Plunging type – when intrathoracic pressure raises as when the patient coughs, lower border is seen in the neck.

Retrosternal goitre however can cause severe symptoms.

- Dyspnoea – particularly at night with cough and stridor, due to pressure on trachea.
- Dysphagia – due to pressure on oesophagus.
- Pressure on great veins at thoracic inlet gives rise to enlargement of veins on neck and front of chest.
- In severe cases there may be obstruction of superior venacava.
- Retrosternal goitre may be toxic or malignant. A chest radiograph in case of retrosternal goitre shows widened soft tissue shadow in superior mediastinum sometimes with calcification and often causing deviation and compression of trachea.

COMPLICATIONS OF MNG

The complications of MNG are as follows:

1. **Secondary thyrotoxicosis** [25]

Its incidence is difficult to estimate but figures as high as 30% are reported.**21** In many cases of toxic nodular goitre the nodules are inactive and it is the internodular tissue that is over active and is due to a family of IgG immunoglobulins which bind with TSH receptor sites (TRABS) and activates TSH receptors on follicular cell membrane. They have a more protracted action than TSH (16-24 hours versus 1.5 to 3 hours).

However in some toxic nodular goitre one or more nodules are overactive and here the hyperthyroidism is due to autonomous thyroid tissue as in toxic adenoma and is termed as plummer's disease.

2. **Tracheal compression**

It may be due to gross displacement of trachea in lateral or anteroposterior plane. It is commonly due to haemorrhage into a nodule and in retrosternal goitre.

3. **Malignant change** [26, 27]

It is one of the most controversial subjects which are still not settled. It is an uncommon complication. The incidence of carcinoma in MNG has been reported as 5-10%.**7** In this view Sokal has reported that 4% to 17% of nodular goitre develops thyroid cancer26, 27. The malignancy is usually of follicular type.

APPROACH TO MULTINODULAR GOITRE [28,29,]

The thyroid nodule may be palpable or hidden and symptomatic or asymptomatic. The thyroid nodules of less than 1-2 cms are not palpable. The gland may be normal or abnormal in structure and function.

Case history

The symptoms are important evidence to know whether hyper or hypo-thyroidism is associated with goitre. The patient and family members

may have noticed alteration in mental activity irritability or excitability. The patient may give history regarding alteration in temperature tolerance, perspiration and change in weight, bowel habits and appetite or eye changes or palpitation. Pressure symptoms like dysphagia, hoarseness of voice, or dyspnoea may occur with goitre. A history regarding diet, ingestion or goitrogenic foods like cabbage, soyabeans and drugs should be elicited. History of having stayed in endemic area and family history of similar swelling should be recorded

General physical examination [30]

Here the signs of hyper or hypothyroidism are to be recorded. Tachycardia during sleep and loss of weight in hyperthyroidism, whereas bradycardia and weight gain are seen in hypothyroidism. The extremities will be hot and moist in hyperthyroidism and cold and dry in hypothyroidism. Tremors of hand and tongue are seen in hyperthyroidism.

Eye signs are characteristic of primary thyrotoxicosis and these include Stelwag's sign, Van Graef's sign, Joffroy's sign and Moebius sign. In secondary thyrotoxicosis the eye signs are not the characteristic feature.26 Local examination Inspection It is the most important part of examination. It provides lot of information and thyroid gland is confirmed by movement with deglution. To know the retrosternal extension of the goitre, one must look for the lower border of the gland. palpation the gland is palpated both

from behind and in front of the patient, for better palpation of localized nodules. During palpation consistency and type of enlargement of the gland is noted. The surface is bosselated with gross varying of consistency in MNG, where as in thyroid carcinoma the consistency is hard, with indistinct margin and irregular surface. If lower border of the gland is not felt, it suggests retrosternal goitre. Examination of regional lymph nodes, carotid pulsation and position of trachea must be done routinely.

INVESTIGATIONS FOR MNG

Diagnostic tests of thyroid function and structure

Now-a-days varieties of tests that provide objective evidence of the status of thyroid function and to assess the thyroid lesions are increasing constantly. No single test or procedure consistently yields a reliable result for diagnosis, but each test has a specific indication. Most frequently the results of tests combine to provide a correct overall assessment of thyroid function and structure.

I. Tests for thyroid function

1. Thyroid hormones (T4 and T3) assay
2. Tests of thyroid binding proteins
3. Free thyroid hormone indices
4. Free thyroid hormone measurements (FT4 and FT3).

5. Pituitary thyroid axis (TSH) assay

6. Hypothalamic – pituitary axis (TRH test)

II. Dynamic and Imaging studies of the Thyroid

1. Radioactive iodine uptake (RAIU) study

- TSH stimulation test
- T3 Supression test
- Perchlorate discharge test

2. Thyroid scintigraphy

- Routine Scintigraphy
- Whole body Scintigraphy for thyroid metastasis

3. Miscellaneous radioisotope imaging tests

- Gallium/ thallium
- Other radiopharmaceuticals – DMSA

III. Assessment of thyroid anatomy

- Ultrasound scan
- Fluorescent scanning
- Computerised tomography (CT)
- Nuclear magnetic resonance imaging (NMRI).

IV. Tissue diagnosis

- FNAC
- Core needle biopsy

V. Measurement of thyroid autoimmunity

- Anti-thyroglobulin antibodies
- Antimicrosomal antibodies
- Long acting thyroid stimulator (LATS)
- Thyroid stimulating immunoglobulins (TSI)

VI. Miscellaneous tests

- X-ray of the neck – AP and lateral vews
- X-ray of the chest - PA view
- Indirect laryngoscopy
- Thyroglobulin assay
- Calcitonin assay

Hormonal Assay

Total thyroid hormones [31]

Total T4 and T3 are measured by specific radioimmunoassay. Since they are highly protein bound, their values depends on the levels of the binding proteins in the serum. Most patients with hyperthyroidism with normal levels of protein have high T4 and T3 less commonly only T3 is high

(T3 toxicosis) and this is more characteristic of hyperthyroidism due to a functioning autonomous nodule, early Grave's disease or those replacing after stopping anti-thyroid drugs. The normal total plasma T4 level is approximately 8 micro g/dl and plasma total T3 level is 0.15micro g/dl.32

Causes of high level of thyroid hormones

- Hyperthyroidism
- Increased binding proteins

- Pregnancy
- Oral contraceptive
- Active hepatitis
- Hereditary
- Porphyria
- New born
-
- Antibody to thyroid hormones
- Pituitary resistance to thyroid hormones

Causes of low levels of thyroid hormones (total)

- Hypothyroidism
- Decreased binding proteins

- Androgens
- Nephrotic syndrome
- Hereditary
- Glucocorticoids
- Cirrhosis of liver
- Low T3 syndrome
- Low T3 and low T4 (sick euthyroid)

Tests of thyroxine binding proteins

For estimation of TBG and TBPA there are specific radioimmunoassay tests. Because TBG is the most important protein, carrying 70-80% of the hormone, it is usually measured alone.

Thyroxine binding capacity (TBC) can be measured indirectly by quantitating the capacity of binding sites in serum, which are not carrying hormone. This is done using the T3 resin uptake test (T3RU) and usually it is in the range of 25% to 35%. If there are a lot of unoccupied binding sites on the proteins, the racer will bind there and the T3RU is low and vice versa. Knowledge of T4, T3 and T3RU values makes it possible to determine if the problem is due to thyroid diseases, or to a binding protein abnormality. If both the tests are abnormal in the same direction, the thyroid is at fault, Eg. If T4 and T3RU are both high, hyperthyroidism is diagnosed. In contrast if one test is high and the other low, the defect is due to carrier proteins.

Free thyroid hormone indices (by calculation)

This is obtained by the formula:

FT4 I= (Total T4) (T3RU)/100

FT3 I= (Total T3) (T3RU)/100

These tests have gained widespread acceptance in practice because the two tests used for its derivation are simple and are robust.

Free thyroid hormone (FT4) measurement

FT4 can be measured by two methods, Equilibrium dialysis or radioimmunoassay. It is generally accepted that the dialysis method is the gold standard, however it is restricted to research laboratories.

Radioimmunoassay is sensitive and specific. FT4 measurement provides excellent index of thyroid status in almost any clinical situation with the few exceptions, which are very rare. E.g. Heparinized patients and in acute psychiatric illness. This test is not influenced by abnormalities in the thyroid binding proteins.

Pituitary Thyroid axis – TSH

TSH radioimmunoassay became available in 1965. When TSH is above normal and T4 and T3 are normal, it is called subclinical hypothyroidism. But older assay could only differentiate TSH levels of 1 μu/ml or 2 μu/ml and since many euthyroid individuals have TSH levels of

0.5μu/ml to 2.0 μu/ml, assay could not separate suppressed values from normal values, but with the introduction of immunoradiometric assay (IRMA) and amplified enzyme linked immunoassay (AEIA), TSH levels less than 0.3 micro units/ml can be detected. TSH is an extremely valuable diagnostic aid, hypothyroid patients have high levels and hyperthyroids have low levels, provided pituitary insufficiency is excluded. When thyroid hormones are at normal level and TSH in undetectable it is called subclinical hyperthyroidism.

Hypothalamic pituitary axis (TRH Test)

This is tested by injecting TRH intravenously and evaluating the response of the pituitary to secrete TSH. A normal response is a rise in TSH, which is maximal at 20-30 minutes with return to normal by 60-90 minutes. In hyperthyroidism the pituitary is suppressed by thyroid hormone and there is no rise in TSH after injection of TRH.

This test was of great value in understanding the physiology and pathophysiology of the hypothalamic pituitary thyroid interaction and it was valuable clinically in the diagnosis of borderline hyperthyroidism. Because of the development of sensitive TSH measurement, which shows suppressed levels in hyperthyroidism the TRH test is superfluous in this role. Patients with primary hypothyroidism have an elevated TSH by definition; therefore TRH test is also superfluous in this situation.

Thyroid Antibodies31:-

If serum thyrotropin level is elevated, serum antithyroglobulin or antithyroperoxidase antibody assay is useful for diagnosis of Hashimoto's thyroidits. However, the finding of an elevated level does not obviate the need of FNAC, to rule out a coexisting cancer including lymphoma.

FINE NEEDLE ASPIRATION CYTOLOGY (FNAC)33,34,35,36 :

FNAC has become established as the choice of investigation in thyroid swellings. It has excellent patient compliance, is simple and quick to perform in outpatient department and is readily repeated.

Procedure 30: It is carried out with the patient in supine position with a pillow placed under the shoulders and neck well extended. It is performed with a 10 cc or 20 cc syringe coupled with a fine 22, 23 or 25 gauge needles. The nodule is secured firmly between fingers, and while suction is applied, 2-6 passes are made into the nodule.

Suction is released before exiting the nodule or as soon as material appears at the hub of needle. If the sample enters the syringe, part or the entire specimen may be lost in the syringe. This technique, although simple to perform, is subject to the operator's experience. It is dependent on the placement of the needle, the sensitivity of the finger tips and the amount of suction applied. Recently, a technique of needle aspiration without suction i.e. fine needle non aspiration cytology (FNAC) is advocated to reduce

traumatic blood aspiration and has been particularly useful in smaller nodules**37**. This technique uses the needle for cutting and the capillary pressure of tissue for sampling. Air-dried smears and wet smears are obtained concurrently. Airdried smears include the Diff-Quick and the May-Grunwald-Giemsa methods. After carefully expelling the sample on a glass slide, the aspirate is allowed to air dry. The air-dried smear highlights the background colloid, the cell architecture, and the cytoplasmic details. This technique is helpful for the diagnosis of medullary and lymphoid tumors. The Papanicolaou stain is a wet smear that requires immediate fixation with 95% alcohol. This method enhances nuclear morphology such as grooving and inclusions, and is better suited for detecting papillary carcinoma. An adequate smear consists of at least 5-6 groups of follicular cells, with each group containing at least 10 cells. The aspirate content can be spinned down in the laboratory and cells that have precipitated can be processed as a larger tissue sample (cell block). Cell block processing has the potential of increasing accuracy of FNAC, particularly for FNAC that is labeled as "suspicious ".

Ancillary tests to improve the accuracy of FNAC include immunohistochemistry , ploidy studies, molecular markers and more recently, Reverse Transcription-Polymerase Chain Reaction (RT-PCR.), to detect thyroglobulin mRNA and thyrotropin- receptor mRNA. This RT-PCR

technique is most useful when an FNAC is obtained from an adjacent lymph node [38].

Complications from FNAC are neither significant nor frequent.

Cytological and histological features of different thyroid disorders [23]

1. Normal thyroid:

Small clusters and sheets of epithelial cells with small amount of thin colloid, C cells, cartilage, tracheal epithelium and skeletal muscle may be found.

2. Nodular colloid goiter:

Diagnostic criteria are as follows:

- Abundant colloid of both thick and thin types
- Follicular cells in sheets and clumps, fragile feathery cytoplasm, numerous bare nuclei
- Foamy cells
- Degenerating erythrocytes
- Hyalinized stroma

3. Grave's disease: (Primary hyperplasia)

- Blood stained smear with little colloid
- Moderate amount of epithelium and some follicular and ring structures

- Enlarged cells with more abundant vacuolated cytoplasm, variation in nuclear size
- Fire flares/ colloid suds/ marginal vacuoles are the features in this disorder

4. Hashimoto's thyroiditis:

- Presence of Ashkenazy
- Moderate number of lymphocytes mainly of small mature type and scattered plasma cells
- Small multinucleate giant cells, epitheloid histiocytes.
- Thyroid follicles disrupted and the follicular basement membrane is
- damaged with enlarged epithelial cells with characteristic oxyphilic change in the cytoplasm

5. Mulitnodular goiter:

Microscopically there will be normal to hyperplastic foci of thyroid tissue, large areas of colloid, hemorrhage, fibrosis and calcification, variable amounts of lymphocytic infiltration can also be seen.

6. Follicular adenoma:

These are 3 types, according to their architecture, cellularity and amount of colloid. They are fetal colloid, embyonal and Hurthle cell types. Hurthle cell lesions contain cells that are markedly eosinophilic and whose cytoplasm contains abundant mitochondria.

7. Follicular carcinoma:

These may be non invasive (minimally invasive) or invasive (angio and capsular invasion). In few cases Hurthle cells are present which show aggressiveness of the tumour.

8. Papillary carcinoma:

Presence of colloid filled follicles with papillary projections. In some cases calcified lesions are found which are called Psamomma bodies, which is diagnostic feature of papillary carcinoma. In few cases, presence of orphan eyed nuclei Annei with a pale empty nuclei may be seen.

9. Medullary carcinoma:

Dispersed cell pattern, cuboidal cells with oval, eccentric pleomorphic nuclei and well defined gray blue cytoplasm, spindle cell forms with elongated cytoplasm, red cytoplasmic granularity and presence of amyloid material in the background are the characteristic features.

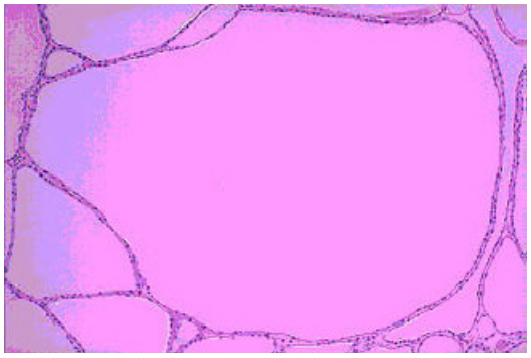
10. Anaplastic carcinoma:

Bizarre, large malignant cells with macrophage like appearance, multinucleate malignant cells, and malignant spindled cells with mesenchymal appearance and necrotic cell fragment debris with a dirty background are the features.

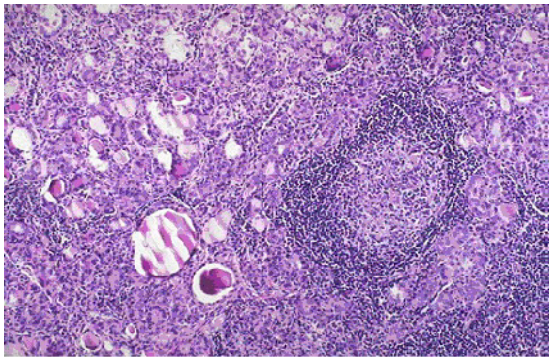
11. Lymphomas:

Shows mixed cell population resembling reactive processes like elsewhere in the body.

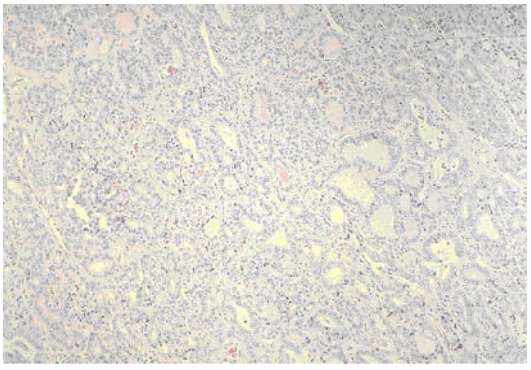
HISTOLOGICAL FEATURES OF DIFFERENT THYROID DISEASES:



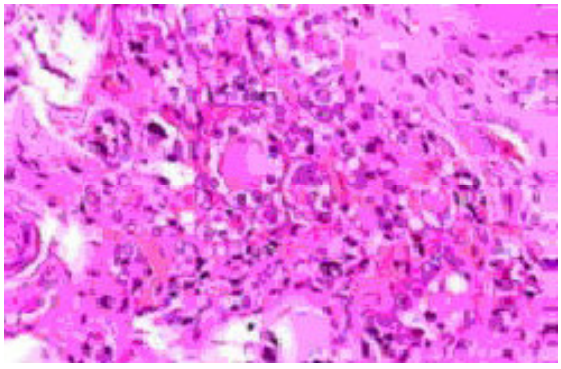
Slide 1: Colloid goiter



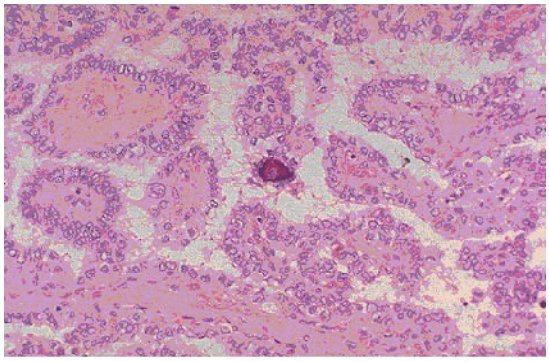
Slide 2: Hashimotos thyroiditis



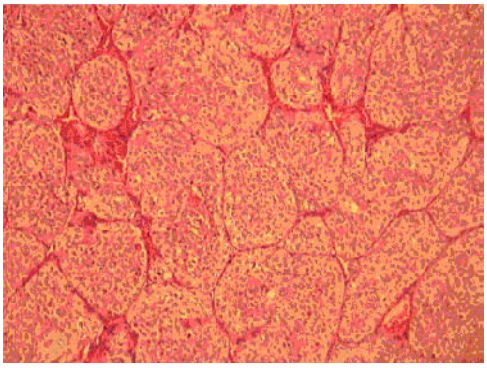
Slide 3: Follicular adenoma



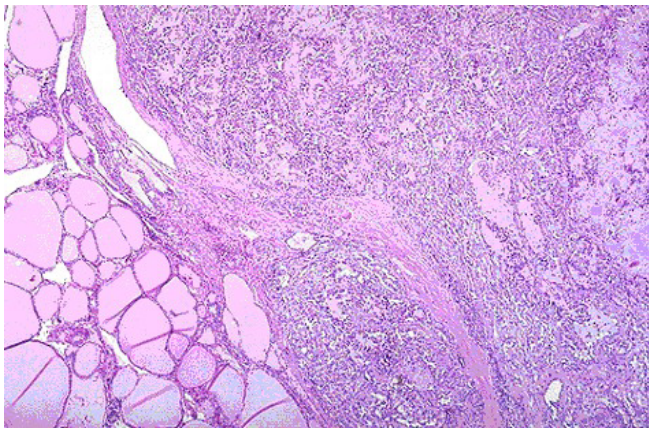
Slide 4: Follicular carcinoma



Slide 5: Papillary carcinoma



Slide 6: Anaplastic carcinoma



Slide 7: Medullary carcinoma

Complications of FNAC

Pain	Fibrosis
Formation of calcification	Cystic degeneration
Hematoma	Transient thyrotoxicosis
Necrosis of nodule	Transient bradycardia
Entry into trachea	Elevation of thyroglobulin level
Capsular pseudo invasion	Transient vocal cord paralysis
Transient thyroid swelling	

Accurate diagnosis can be made in colloid nodules and inflammatory thyroid disease. (Hashimoto's thyroiditis, De Quervain's thyroiditis and tuberculosis). Papillary, medullary, anaplastic cancers and thyroid lymphomas are diagnosed with ease. But diagnosis of follicular cancers is virtually impossible30. If the cytology is bizarre, medullary cancer must be excluded by staining for calcitonin and serum calcitonin analysis [22.]

After FNAC, the majority of nodules can be categorized into following groups 37, 38, 39.

- Benign (65%)
- Indeterminate or suspicious for follicular cell neoplasm (20%)
- Malignant (5%)
- Non diagnostic (10%)

FNAC has sensitivity of 83% and specificity of 92%. The incidence of false positive results is approximately 1% and false negative results occur in approximately 3% of patients [32.]

Benign lesions include cysts and colloid nodules.The risk of malignancy in this setting is less than 3% [3]

The risk of malignancy in the setting of suspicious cytology is anywhere from 10 to 20%. Most of these lesions are follicular or Hurthle cell neoplasm. In this situation, diagnosis of malignancy relies on demonstrating capsular or vascular invasion, features that cannot be determined via FNAC.

There is a little or no value in repeating FNAC for a follicular or Hurthle cell lesion. However, no effective method has been found to identify malignant lesions that yield indeterminate cytologic result upon FNAC, except for some promise about using immunohistochemistry methods for follicular neoplasm. So, it is best to treat all suspicious cytology surgically.[37,38]

RADIOGRAPHY:

Chest and thoracic inlet radiographs are only necessary when there is clinical evidence of tracheal deviation or compression or retrosternal extension. This is helpful to diagnose the position of the trachea whether displaced or narrowed. Straight X- ray is also helpful in diagnosing retrosternal goitre40

ULTRASOUND:

It has a value to differentiate between solid and cystic swellings. It also demonstrates clinically impalpable nodules and Lymph Nodes. But its value to diagnose malignancy is limited.

Sonography demonstrates in some patients that a single, clinically palpable nodule is one of many sonographically visible nodules is of the most likely diagnosis in Multinodular Goitre. The clinical differentiation is important since the risk of cancer is less in Multinodular Goitre.36 Recent

data suggest that 50% of patients with a single nodule have other nodule demonstrated by careful USG. [41]

CT AND MRI:

These newer methods have not yet proved themselves very helpful in detecting day- to- day thyroid disorders. These are still in the experimental stage. [40]

THYROID AUTO- ANTIBODIES:

Serum titres of antibodies against thyroid peroxidase and thyroglobulin are useful in determining the cause of thyroid dysfunction and swellings. Autoimmune thyro iditis may be associated with thyroid toxicity, failure or euthyroid goitre. Titres of greater than 1:100 are considered significant but a proportion of patients with histological evidence of lymphocytic (auto immune) thyroiditis is seronegative.

INDIRECT LARYNGOSCOPY:

To determine the mobility of the vocal cords is widely used preoperatively, although usually for medicolegal rather than clinical reasons. To see the condition of the vocal cords to exclude injury to the Recurrent Laryngeal Nerve during operation. So laryngoscopy should also be performed just after operation. Only in 3% of cases there may be symptomless cord paralysis. These cases are to be segregated from cord

paralysis due to Recurrent Laryngeal Nerve injury during operation by Laryngoscopy preoperatively.[42]

CORE NEEDLE BIOPSY:

This is done under local anaesthesia is occasionally of value in establishing diagnosis in patients with a large often hard and fixed mass in the neck frequently on the basis of anaplastic carcinoma or t hyroid lymphoma. Core biopsy produces a small cylinder of tissue which is subjected to histopathological examination because of the caliber of the needle and the consequent hemorrhage, haematoma, perforation of Trachea and damage to Recurrent Laryngeal Nerve.[43]

TREATMENT

There are three main approaches to the treatment of this condition.

1. MEDICAL
2. RADIOIODINE
3. SURGERY

Non specific measures such as rest, sedation and ß adrenergic blockers are helpful to treat this condition. Indications for therapy in patients with multinodular goitre including hyperthyroidism.

1. Compression symptoms attributed to the goiter.
2. Cosmetic concerns of patient.

4. Concern about malignancy based on the history, examination and fine needle aspiration cytology.
5. Recent growth.

MEDICAL TREATMENT

***Levothyroxine suppression therapy**:*

The use of thyroid hormone in suppression of multinodular goitre is controversial. Thyroid hormone prescribed in an attempt to reverse or prevent thyroid growth by suppressing TSH's direct thyrotrophic effect and any indirect permissive effect on other growth factors such as epidermal growth factor. The goal of suppression therapy is a serum TSH level in the low normal range. Further TSH suppression is not recommended, in order to avoid possible untoward side effects of subclinical hyperthyroidism. A modest dose of levothyroxine (100 mcg) is usually adequate, but monitoring of the serum TSH is recommended to determine dosage adequacy. Both levothyroxine and levotriiodothyronine are equally effective in suppressing TSH levels but the former is preferred because of its much longer half life, which renders it potentially less toxic and aids in ease of patient use. Patient compliance with therapy is important, because multinodular goitre growth resumes if treatment is interrupted or discontinued. [44]

Potential disadvantages of thyroid hormone suppression therapy in patients with multinodular goitre, in addition to its debated efficacy, include subclinical or frank hyperthyroidism with the potential for bone loss and card iac dysrhythmias. Indeed, subclinical hyperthyroidism from functional autonomy of the nodular goitre, defined as blunted TSH response to TRH stimulation, is present in upto 27% of clinically euthyroid patients with multinodular goitre. There is no study in which normalization of the thyroid volume and disappearance of nodules is documented convincingly. Thus hormonal suppressive treatment cannot be accepted as a reasonable long term treatment for euthyroid nodular disease.[45]

Antithyroid drug therapy: The reported success of long- term antithyroid drug use in the treatment of toxic multinodular goitre is extremely poor. Of the 41 patients studied by Van Soestbergen and colleagues41/39(95 %) developed recurrent hyperthyroidism following cessation of antithyroid drug therapy. The mean time of relapse was 5.2 months with 95 percent relapse occurring within the first year. Because prolonged antithyroid drug therapy in patients with toxic multinodular goitre seldom results in permanent remission and recommended only as adjunctive therapy when needed for the initial control of hyperthyroidism. The preponderance of the evidence suggests that it is not helpful to use combined antithyroid drug- thyroxine therapy to enhance the chance of remission. [46]

Radioiodine therapy and toxic multinodular goitre

The clinical utility of radioiodine therapy in the management of toxic multinodular goitre is well established. So as not to skew the results of reported successful radioactive iodine therapy in patients with toxic multinodular goitre, however, one must be careful to separate patients with multinodular goitre from patients with diffuse goitre5, Graves' disease, and single toxic adenoma. In addition, thyroid size and nodularity are assessed only by palpation in many s tudies, and others do not clearly define the duration of follow up in assessing response to radioactive iodine therapy. Nevertheless, a large number of patients with toxic multinodular goitre eventually achieved a 92 per cent euthyroid success rate following treatment with modest doses of radioactive iodine (25 milli Curies of I131 of less); others have reported similar (70 percent to 88 percent) results.[45]

In patients with toxic multinodular goitre studied by Jensen and colleagues (estimated average gland weight by palpation 61 g), the mean radioactive iodine treatment dose was 37 mCi of I131, which yielded a 57 percent probability that the patients would become euthyroid after one year. Twent y- five per cent of these patients required a second radioactive iodine treatment within the first year for persistent hyper- thyroidism. A statistically significant association was not seen between successful treatment of hyperthyroidism and estimated gland size or radioactive iodine dose

administered per gram tissue. Although some authors report only a 3 per cent to 7 per cent persistence rate for hyperthyroidism when a much large radioactive iodine dose is used, this has not been observed by others. Thus in treating patients with a large toxic multinodular goitre surge ry is preferred over radioactive iodine therapy, because of the more rapid resolution of hyperthyroidism.[45]

The actual overall incidence of hypothyroidism following radioactive iodine therapy is low (3 per cent to 9 per cent) in studies exclusive of single nodule and diffuse goitre. Life table method of calculating hypothyroidism after RI therapy in toxic multinodular goitre is more variable, yielding rates of 6% to 64%. It appears that the development of hypothyroidism is variable and likely reflects the early post- radioactive iodine success in treating toxic multinodular goitre.

Plummer's disease as drug uptake is variable, there is minimal impact on the size of the gland and response is slow. Surgery is best carried out sooner rather than late to avoid compromise of the airway and the cardiovascular system..[47]

Day TA, CHU A. Hoang KG In studies shows a thyrotoxicosis is often present in patients with long studying in multi nodular goiter, although the slow changes in thyroid functions may not have been noticed by the individual toxic and non toxic multinodular goiter should be addressed

separately and the type of treatment should be directed at each of these types of multinodular goiter as well as the issues related to the success of each treatment options.[48]

Alcohol sclerotherapy:

In use for the last few years mainly in Italian centers in solitary hot or toxic nodules and solitary cyst, alcohol sclerotherapy could theoretically be used in Multinodular Goitre. The drawbacks are related to pain risk of Recurrent Laryngeal Nerve damage and the possibility of extrathyroidal fibrosis complicating subsequent surgery.

Radioiodine therapy and nontoxic multinodular goitre

Surgical excision is preferred in patients with nontoxic multinodular goitre when treatment is necessary to address compression symptoms or cosmetic concerns. If, however, the surgical risk, is high or if patient refuses surgery, radioactive iodine therapy is a reasonable alternative. In two studies using RI to treat multinodular goitre causing compression symptoms, median reduction in thyroid volume was 40% and 60% after one year and two years, respectively. As with radioactive iodine treatment of toxic multinodular goitre, there is no relationship between initial goitre size and thyroid volume reduction. Although it is not uncommon to see an initial increase in thyroid volume at one month after radioactive iodine therapy, treatment does not aggravate obstructive symptoms. [48]

In the past, radioactive iodine therapy for multinodular goitre was almost universally reserved for elderly patients who were poor surgical risks. Because radiation induced carcinogenesis is a late effect, the risk of radioactive iodine, inducing cancer in the elderly population is small. No data, however, exists for the incidence of radioactive iodine - induced malignancy in the treatment of multinodular goitre at any age. The effect of high dose of radioactive iodine administration in patients with multinodular goitre is not comparable to that in patients treated after thyroidectomy for thyroid cancer, because of the difference in extrathyroidal radioactive iodine exposure between the two groups. For treatment of large multinodular goitres, dosimetry determination of radioactive iodine dose may be potentially helpful in ensuring initial therapeutic success and in preventing a blood dose no more than 200 rad (2Gy).

SURGERY:

Argument for routine removal of nodular goiter :

This subject supports the view that the incidence of malignancy among the non-toxic MNG is quite high and the most or all such goiter should be removed as soon as they are detected, because of the risk of cancer. It has been claimed that many lives could be saved by systematic search for the removal of nodular goiters based on the following consideration.

Many surgical centres throughout the world have statistics, indicating that 4-17% of all non-toxic goiter removed were malignant.

Even though nodular goiter may be benign at the time of detection, it is likely to become malignant later and sho uld therefore be removed as cancer prophylaxis. Lahey stated that prophylaxis removal of all discrete nodules would do much to lower, if not abolish the occurrence of thyroid cancer. This history of pre-existing nodular goiter often of long duration was e licited in many series of thyroid cancer. Some authors cited the individual history of patient with quiescent benign nodular goiter, which began to grow rapidly, and proved to be thyroid carcinoma. Sokal states (49) that some nodules might be malignant from the start for which series of histopathological studies during every stage of evolution of the goiter may be helpful to come near to conclusion and to find out that the histopathological abnormality is the earlier stages to predict malignancy later. [(50)]

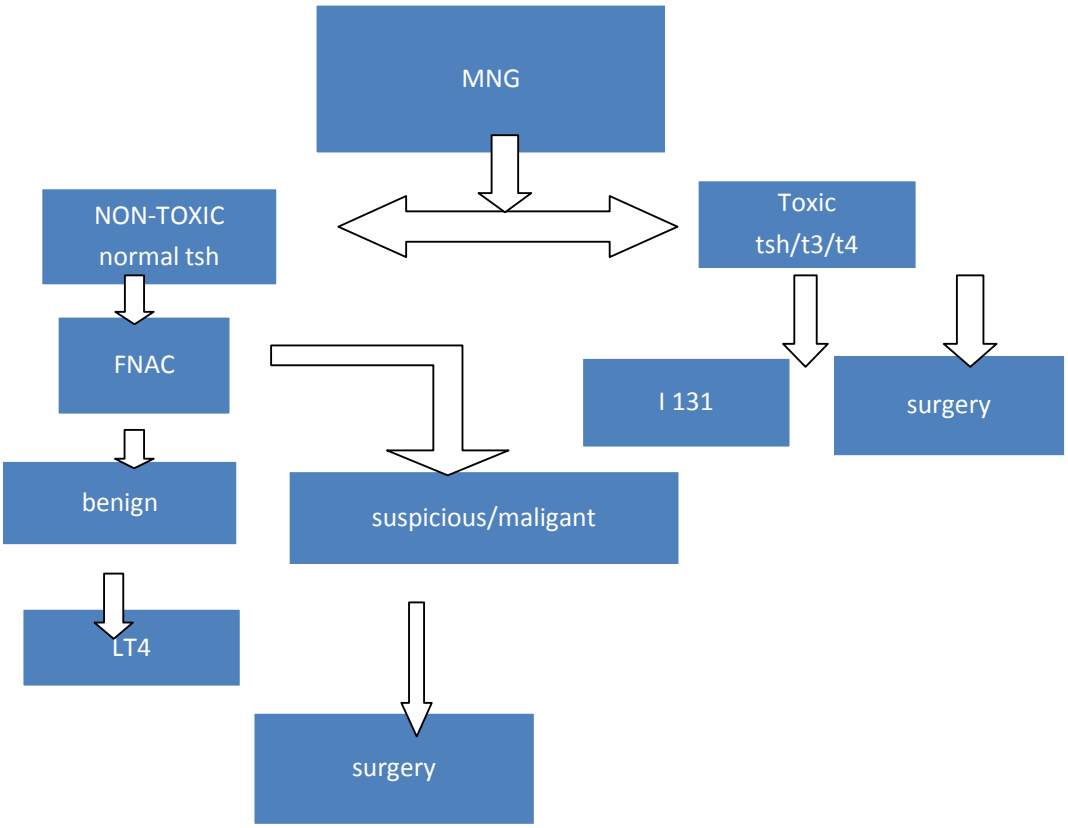
Vini L and associates reported that differentiated thyroid cancer found incidentally at surgery for hyperthyroidism has a good prognosis.

Argument against removal of nodular goitre :

- The selection of statistics from the centre is highly selective and is not representative of population in general

- ❖ Nodular goitre is quite common in endemic areas but the thyroid cancer is rare.
- ❖ Clinically correct diagnosis may be made between benign and possibly malignant swellings.
- ❖ Benign goiters rarely undergo malignant transformation and there is no assurance that surgery will prevent the thyroid cancer.

MANAGEMENT OF CASE OF MULTINODULAR GOITRE



SURGERY OF THE THYROID GLAND:

Bliss R stated that surgery in elderly patients is as safe as in younger patients with no increase in morbidity. Benign MNG is the most common indication for surgery. [51]

Following are the operations done in non-toxic and toxic MNG :

Management of patients with MNG band on thyroid function (serum TSH, T4/T4) and thyroid fine needle aspiration cytology.

I) Subtotal Thyroidectomy :

It is a standard operation undertaken for toxic MNG. Approximately 7/8th hyperplastic gland is removed retaining the posterior margin in order to maintain a euthyroid level and to protect the parathyroid gland the recurrent laryngeal nerve.

The care of non-toxic goiter, it is advisable to leave an amount equal to a normal gland. Only the enlarged amount is resected.

Contraindication: Subtotal thyroidectomy is contraindicated in persons with thyrotoxic congestive cardiac failure. Particularly when cardiac reserve is low and the goiter is small and adherent such patients are recommended radioiodine therapy. It is also contraindicated in ophthalmoplegia, for rapid reduction of the toxic stage may worsen the eye condition and at least 6 months control by anti – thyroid drugs such as carbimazole should be under taken before subtotal thyroidectomy can be safely performed.

II) Near total thyroidectomy . Total Thyroidectomy :

The reported incidence of nodular recurrence following subtotal thyroidectomy for MNG range from uncommon is 10%. Kraimp and colleagues reported that following subtotal thyroidectomy recurrent nodularity developed in 25 to 735 (3.4%) patients with MNG. 25% of nodular recurrences occurred in each follow up period of 0-5 years and 5-10 years. 50% of patients with recurrence had so more than 10 years after surgery. Immediately post operative thyroid hormone therapy may have delayed, but did not prevent recurrence and once post operative nodule recurrence was documented thyroid hormone treatment did not inhibit further growth.[52]

Most likely the best prevention of recurrent post operative MNG is near total thyroidectomy. The experience hands complications of total thyroidectomy are no different from those of subtotal thyroidectomy. (53)

Operation Steps in Surgery :

Preparation of the patient – the fitness for the surgery is decided by the status of the hemoglobin, cardiovascular condition, respiratory system as usual oral hygiene is improved to avoid post operative respiratory complications. When the patient is toxic, the toxicity must be brought down to the euthyroid state before surgery either by sedation alone or in combinations with anti – thyroid drugs carbimazole 30-40 mg/day in divided

doses until toxicity comes down and followed by 5mg every 8t h hourly as maintenance does. The response to the treatment is assessed by subjective improvement of the symptoms, slowing of the pulse rate and thyroid profile tests. Iodides alone are not advocated but some prefer to add Lugol's to carbimazole 10days prior to surgery. Propranolol may be used along with carbimazole in the management of very severe toxicity and to reduce the length of pre operative preparation.

SUBTOTAL THYROIDECTOMY :

Skin Incision and Raising the Flaps

The skin incision can be marked by pressing a length of thread on to the skin before using the scalpel keeping in the of skin crease 2-3cms above the sternum. The collar (Kocher's) incision is then made, extending to the lateral borders of the two sternocleidomastoid muscle. With larger goiters the incision is made little higher up. In order to give a neat scar, the platysma is divided at a slightly higher level than the skin. The flaps of skin, superficial fascia and platysma are divided at a slightly higher level than the skin. The flaps of skin, superficial fascia and platysma are then reflected upwards to the level of the thyroid cartilage and downwards to the sternum. Skin edges are held wide apart. The anterior jugular veins are divided between ligatures.

Exposure of the thyroid gland

The investing layer of deep fascia is incised vertically in the midline. Any anastomosing veins being secured and the interval between the infra thyroid muscle is opened to expose the sheath of pretracheal fascia covering the glands if additional exposure is necessary then the infrahyoid muscles are sectioned about an inch above the skin incision. The pretracheal fascia is now incised and finger is passed over front of each lobe to ascertain its size and extent. As a rule, larger lobe is dealt with first and by retraction of the infrahyoid muscle and fascial sheath the greater part of its anterior surface is exposed.

Thyroid Dissection:

The lateral surface of the lobe is cleared by finger during this procedure. Middle thyroid vein if present is divided between ligatures. The inferior thyroid vein, which forms a venous plexus anterior to the trachea is carefully dissected. The muscles are retracted strongly in an upward and lateral direction and the upper pole if the gland is delivered at the wound. When the vascular superior thyroid pedicle becomes apparent this is divided between ligatures with a double ligatures to the upper stump preferably. A finger is swept around the lower pole, which is delivered forwards, after the inferior thyroid veins are secured. The lobe is drawn forwards and medially and search is made behind it for the inferior thyroid artery. Thus vessel

should be ligated well away from the gland in order to prevent injury to the recurrent laryngeal nerve. The artery is ligated in continuity.

Excision of the Gland :

After taking the decision about the amount of gland tissue to be left behind, several pairs of artery forceps are applied to the capsule of the lobe in its postero-lateral aspect along the line of proposed position. The lobe is then sectioned from lateral to medial side, in a place towards the front of the trachea.

The opposite lobe of the gland is then treated in a similar manner, an equal amount of the gland tissue being left behind. All hemorrhage points being arrested either by fine ligatures or by diathermy coagulation. The wound is closed in layers, first the deep cervical fascia, then platysma and finally skin. Usually drain is kept deep to the deep cervical fascia. Mattioli found that subtotal thyroidectomy is adequate intervention for multinodular goiter, as long as the number of clinical recurrence is not significantly high. (54)

TOTAL THYROIDECTOMY:

Total follows the technique described above except that the entire gland is removed from one tracheoesophageal groove to the other. The technique of this procedure is essentially a bilateral version of hemithyroidectomy. If it is not possible to preserve parathyroid glands intact,

it is preferable to implant them within the sternocleidomastoid muscle rather than to remove them completely. Total thyroidectomy may be successful in effecting cure of carcinoma, and should be advocated in those cases where the growth is sufficiently mobile or if tumour is found in one of the lymphnodes outside the thyroid (Hurgreaves, 1981).(55)

If the tumour is of papillary type and is confined to one lobe, lobectomy with removal of isthmus is usually sufficient.Dissection of lymph node only is carried out when they are involved by tumour. The discovery of isolated lymph node metastasis from a carcinoma of the thyroid which is undetectable clinically (lateral aberrant thyroid) requires total of near total thyroidectomy combined with removal of laterally placed nodes especially in the younger patients (Frankenthaler 1990).(56)

Khadra M and associates stated that in view if the risks of reoperative surgery, total thyroidectomy should be considered the operation of choice for most benign diseases affecting the whole thyroid gland such as multinodular goiter, thyroiditis and goiters affected by thyrotoxicosis.(57)

NEAR TOTAL THYROIDECTOMY:

Surgeons who are uncomfortable performing total thyroidectomy can decrease their patients risk of hypoparathyroidism and recurrent laryngeal nerve injury by using procedure designed to minimize dissection in the contralateral tracheoesophageal groove. Near total thyroidectomy minimizes

dissection because it leaves a few grams if thyroid tissue along the posterior aspect of the contralateral lobe. If near total thyroidectomy is performed, no more than 25% of one lobe (approx 2gm) remains. The surgeon may decide to perform a near total thyroidectomy routinely in situations of relative indications for total thyroidectomy and possibly in selected situations in which precise anatomic dissection is technically difficult.

TREATMENT OF RETROSTERNAL GOITRE:

If obstructive symptoms are present in association with thyrotoxicosis it is unwise to treat a retrosternal goitre with antithyroid drugs or radioiodine as these may enlarge the goitre. Most common substernal goitres arise from the thyroid lobe. [58]

Resection can almost always be carried out from the neck and a midline sternotomy is hardly ever necessary. The cervical part of the goitre should first be mobilized by ligation and division of the superior thyroid vessels, and by ligature and division of the middle thyroid veins and the inferior thyroid artery. The retrosternal goitre can then be delivered by traction and finger mobilization. Haemorrhage is rarely a problem because the goitre takes its blood supply with it from the neck. The recurrent laryngeal nerve should be identified if possible before delivering the retrosternal goiter, as it may be abnormally displaced and particularly vulnerable to injury from traction or tearing. If a large multinodular goiter

cannot be delivered intact from the retrosternal position it may be broken with the fingers and delivered piecemeal, but this should never be done if the lesion is solitary and there is the possibility of carcinoma. Armour and Colleagues,(59) described morcellement can be a messy process and partial claviculectomy offers an easier method while removing difficult retrosternal goitre through the standard approach to the thyroid gland. This technique was helpful in an obese patient with a large retrosternal extension of the goitre.

TREATMENT OF TOXIC MULTINODULAR GOITRE IN PREGNANCY:

Thyroid disease during pregnancy is a significant issue, especially because the incidence of autoimmune disease of the thyroid approaches 10% in women. [60]

A retrospective study suggested that the increased prevalence of thyroid nodules among women may be related to pregnancy. The prevalence of nodular disease is detected by USG, was three times as high in woman who had experience at least one pregnancy compared with women who had never been pregnant. The evaluation of thyroid nodule discovered during pregnancy is similar to that of the non pregnant patient. Nodules with benign cytology should be observed and followed by an endocrinologist. If the FNAC is consistent with thyroid cancer surgery is recommended. Some

experts recommend operating during the 2nd trimester before 24 weeks of gestation to minimize the risk of miscarriage. Some experts advocate postponing definitive surgery until after delivery in most patients.Radioiodine is absolutely contraindicated because of the risk to the foetus.[61]

The danger of surgery is miscarriage; and that of antithyroid drugs is of inducing thyroid insufficiency in the mother, of the baby being born goitrous and hypothyroid

Endoscopic Trans Axillary Thyroidectomy:

Under general anaesthesia, patient kept in supine position and arm abducted to 90 degrees to the vertical axis of the body to expose the axilla. Three 5mm incisions should be made and initial dissection of the working space should be accomplished with blunt 3mm Steinman pins beneath the platysma and anterior to pectoralis major muscle. Three 5mm trochars should be placed through the incisions and directed towards the thyroid gland. Insufflations of CO2 at an initial pressure of 7mmHg pressure should be used to maintain working space dissection and it should be carried out to reach the SCM muscle and thyroid gland. The ipsilateral thyroid lobe should be identified and mobilized. After mobilization of the isthmus from the anterior surface of the trachea, the gland should be grasped and gently retracted anteromedially. This maneuver was facilitated by division of the

sternothyroid muscle leaving the more superficial sternohyoid muscle intact. This will allow greater anterior retraction, exposing the contralateral inferior thyroid pole.

Complete dissection of the junction between the thyroid capsule and the contralateral inferior thyroid vessels should be accomplished. These vessels should be then clipped and divided. Complete mobility of the gland should be accomplished, and the contralateral superior thyroid pedicle should be exposed. The superior vessels were then clipped and divided, freeing the entire gland while protecting the recurrent laryngeal nerve. The gland, completely detached, was placed in an Endocatch retrieval bag and removed through an extended lateral incision within the axilla. The paratracheal spaces were inspected for hemostasis. A 7-mm Blake drain was placed within the thyroid bed and anterior chest wall, and brought out through one of the 5-mm axillary port sites.

Postoperative complications [(62), (65)]

Haemorrhage:

A tension haematoma deep to the cervical deep fascia is usually due to slipping of a ligature on the superior thyroid artery; occasionally haemorrhage from a thyroid remnant or a thyroid vein may be responsible. It may on rare occasions, be necessary to open the wound in the ward to relieve

tension before taking the patient to the theatre to evacuate the haematoma and to tie off a bleeding vessel.

Respiratory obstruction

Most cases are due to laryngeal oedema and very rarely due to collapse or kinking of the trachea. The most important cause of laryngeal oedema is a tension haematoma. However trauma to the larynx by anaesthetic and surgical manipulation is an important contributory factor particularly if the goitre is very vascular and may cause laryngeal oedema without a tension haematoma. Unilateral or bilateral recurrent nerve paralysis will not cause immediate postoperative respiratory obstruction. Unless laryngeal oedema is also present but they will aggravate the obstruction. If releasing the tension haematoma does not immediately relieve airway obstruction the tracheal should be intubated at once. An endotracheal tube can be left in place for several days; steroids are given to reduce the oedema and a tracheostomy is rarely necessary.

Postoperative thyroid crisis

It is an acute exacerbation of hyperthyroidism. It occurs if a thyrotoxic patient has been inadequately prepared for thyroidectomy. Very rarely thyrotoxic patient presents with a crisis and this may follow an unrelated operation. It is characterized by tachycardia, high fever, restlessness and delirium, progressing towards cardiac failure. Symptomatic and supportive

treatment is for dehydration, hyperpyrexia and restlessness. This requires administration of intravenous fluids, cooling the patient with ice packs, administration of oxygen, and diuretics for cardiac failure, digoxin for uncontrolled atrial fibrillation sedation and intravenous hydrocortisone. Specific treatment is by carbimazole 10-20 mg 6 hourly, lugol's iodine 10 drops 8 hourly by mouth or sodium iodide 1 gm intravenously. Propronalol 40 mg 6 hourly orally will block adverse betaadrenergic effects. This may be give by careful intravenous administration (1-2) mg under precise electrocardiographic control.

Parathyroid insufficiency

This is due to removal of parathyroid glands or interference with their blood supply through trauma to parathyroid end artery. The incidence of this condition should be less than 0.5% and most cases present dramatically 2-5 days after operation, but very rarely the onset is delayed for 2-3 weeks or a patient with marked hypocalcaemia is asymptomatic. It is commonly transient in nature and quickly controlled by calcium by mouth. If severe, 20 ml of 20% solution of calcium gluconate is given intravenously i.e, (10 ml of 10% ampoule) and later supplemented with oral calcium.

Recurrent laryngeal nerve paralysis [63]

This may be unilateral or bilateral transient or permanent. Transient paralysis occurs in about 3% of the nerves at risk and recovers in about 3

weeks to 3 months. Permanent paralysis is extremely rare if the nerve has been identified at operation. If recovery does not take place within this period, organic injury to the nerve should be suspected. This may be due to stretching or bruising of the nerve or to its inclusion in a ligature, it is seldom divided. The prognosis regarding the recovery of function is poor if the nerve is divided. Repair of the nerve may be attempted, but the results are uncertain.

Hypothyroidism

This usually occurs within 2 years but may be delayed for 5 years or more. It is often insidious and difficult to diagnose. The incidence is higher than used to be thought and figures of 20 to 45% have been reported after operations on toxic nodular goitres with internodular hyperplasia. It represents a change in the autoimmune response from stimulation to destruction of thyroid cells. Hypothyroidism commonly follows after sub-total thyroidectomy for lymphocytic thyroiditis. The treatment consists of administration of L- Thyroxine 0.1mg to prevent myxedema after analyzing thyroid profile post operatively at 1 week and 1 month.

Recurrent thyrotoxicosis(64)

This is due to either removal of inadequate thyroid tissue or to subsequent hyperplasia of the tissue that has been left. It is not uncommon in primary toxic goiter but very rare in the secondary thyrotoxicosis. Further

operation should be avoided if possible. The best results are obtained by radioiodine or by the anti-thyroid drugs.

Other complications

- Wound infection
- Hypertrophic or Keloid Scar & Stitch granuloma.

METHODOLOGY

The present study of "clinical study and management of multinodular goiter" has been conducted by utilizing the cases diagnosed clinically as MNG and treated on inpatient basis in the department of General Surgery at PSG hospitals Coimbatore. It is a prospective study of all the cases clinically diagnosed as MNG of about 30 cases.

The patients were selected according to the inclusion and exclusion criteria as mentioned below. All these cases were studied in detail, clinically and recorded as per the proforma. The relevant investigations whenever indicated were performed.

The investigations included Hemoglobin percentage, urine analysis, blood sugar estimation, blood urea estimation, blood grouping and Rh typing, x-ray of the neck-AP and lateral views and chest X-ray and ENT examination. For all patients FNAC and thyroid profile was done per-operatively. All patients underwent surgery and all the excised thyroid specimen were sent for Histo-pathological examination. Patients were discharged and were asked to come for follow up. They were advised to take the needful medications after surgery.

Inclusion criteria:

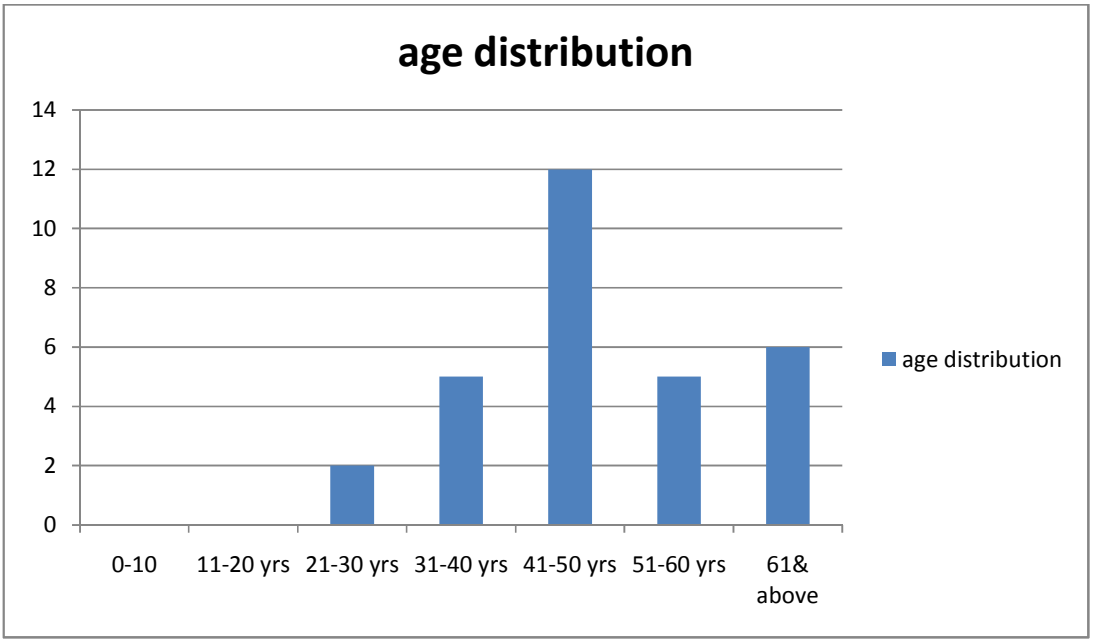
1. Patients with enlargement of thyroid gland, with more than one nodule palpable or enlarged thyroid gland with nodular surface.
2. Toxic and non- toxic multinodular goitres were included in the study.

Exclusion criteria:

1. Diffuse hyperplastic goiter.
2. Solitary nodule of thyroid.
3. Thyroid enlargement with the clinical features suggestive of malignancy.
4. Multi-nodular goitre patients not undergoing surgery were excluded.

RESULTS

In the present study the maximum age recorded was 78 years and minimum age recorded was 28 years with the mean age . Highest incidence was observed in the age group 41- 50 years.

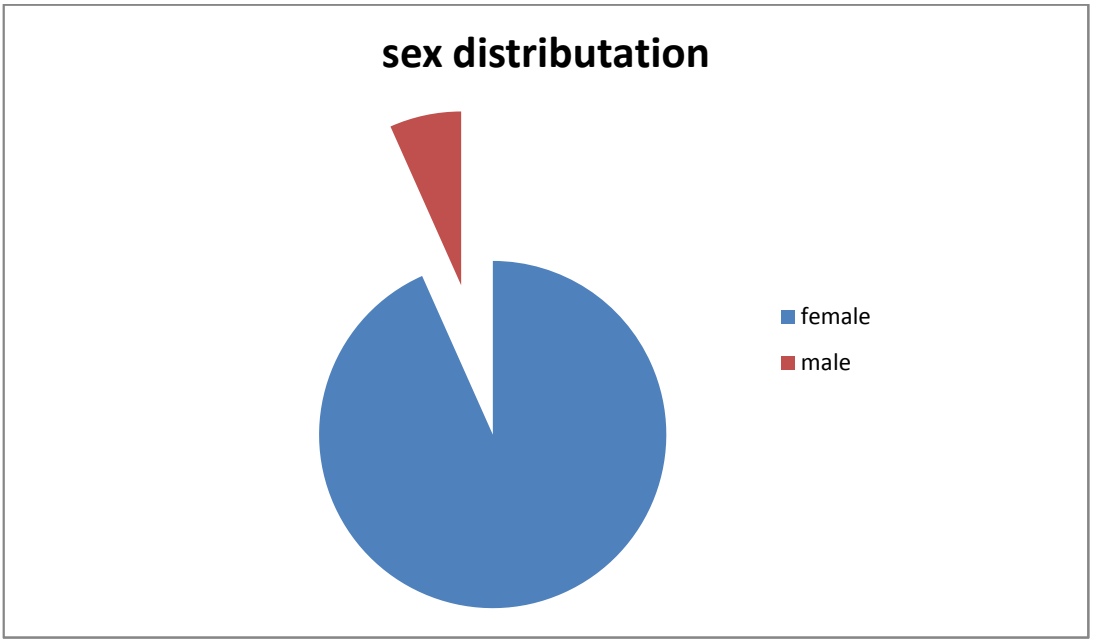


Age	No. of patients	Percentage
0-10 yrs	0	0
11-20 yrs	0	0
21-30 yrs	2	7 %
31- 40 yrs	5	16 %
41-50 yrs	12	41 %
51-60 yrs	5	16 %
61 & above	6	20 %

SEX DISTRIBUTION:

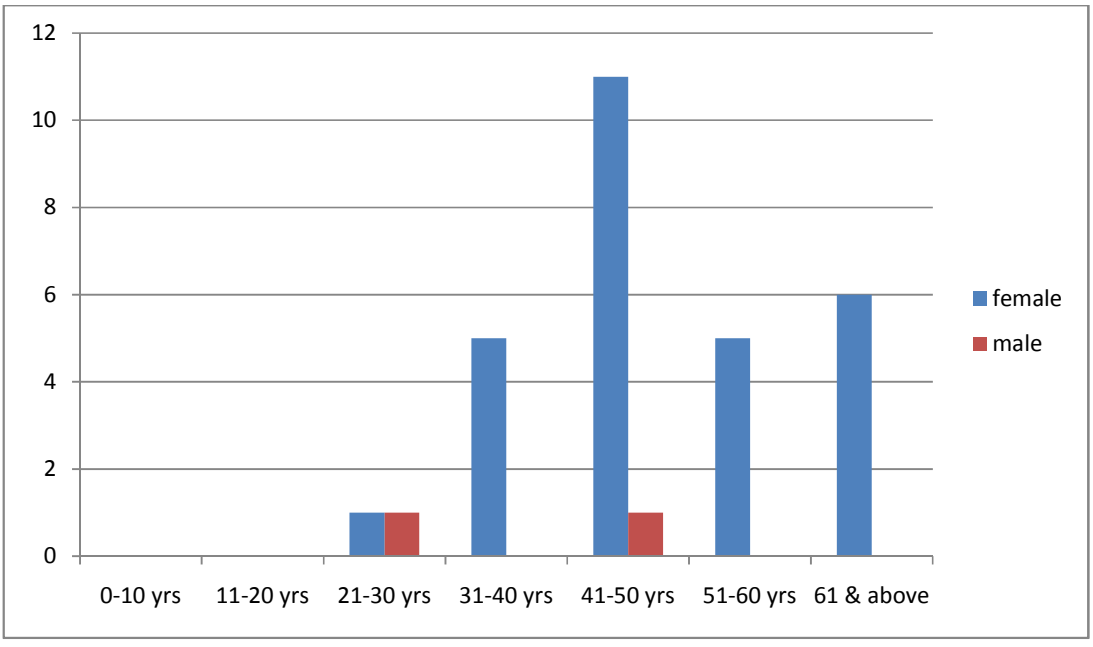
In total of 30 patients screened 28 of them were female and 2 of them male.

Sex	Number of patient	Percentage
Female	**28**	**93 %**
Male	**2**	**7%**
total	**30**	**100 %**



AGE AND SEX DISTRIBUTION

Age in years	Females	Males	No of case	Percentage
0-10 yrs	0	0	0	
11-20 yrs	0	0	0	
21-30 yrs	1	1	2	7%
31- 40 yrs	5	0	5	16%
41-50 yrs	11	1	12	41%
51-60 yrs	5	0	5	16%
61 & above	6	0	6	16%
Total	**28**	**2**	**30**	**100%**



SYMPTOMATOLOGY

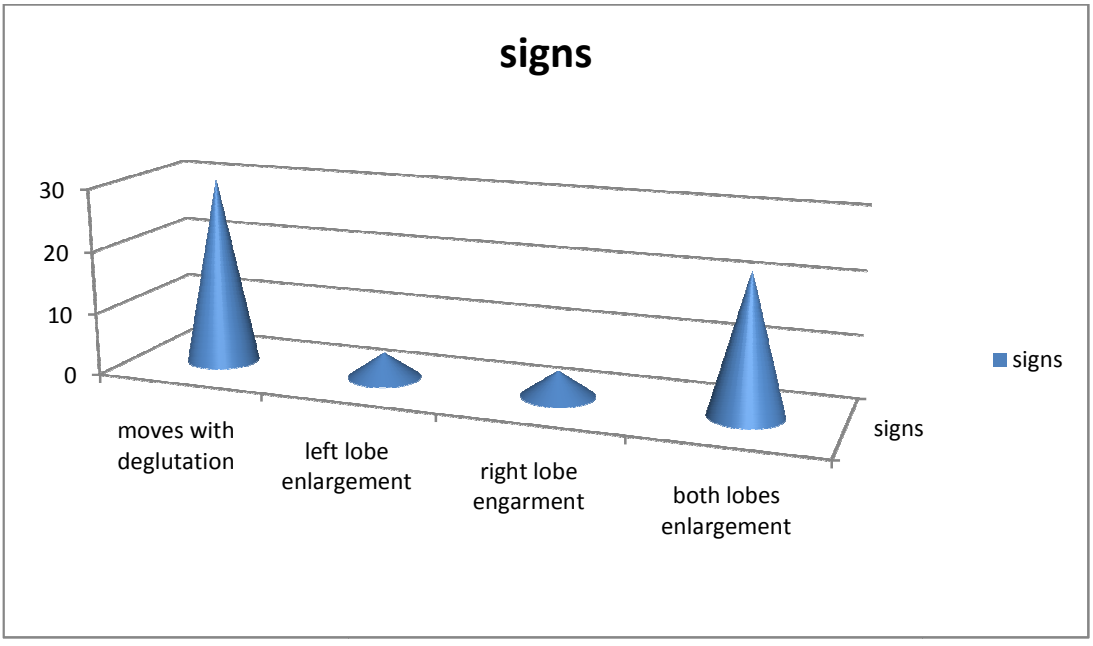
Symptoms	Total no. of patients	Percentage %
Swelling in front of neck	30	100 %
Pain and discomfort	2	7 %
Palpitation	3	10%
Dyspnoea	0	0
Dysphagia	4	13%
Increased sweating	0	0
Increased appetite	0	0
Weight loss	2	7%
Constipation	6	20%
Weight gain	1	3%
Change in voice	1	3%

All 30 patients all had commonest complaints of swelling the front of the neck. Out of them 10 had no complaints other than swelling.

6 (20%) of them were having constipation, 4 (13%) of them dysphagia, 3(10%) having palpitations, 2(7%) having weight loss, 2(7%) having pain & discomfort, 1(3%) having change in voice and 1(3%) having weight gain

PHYSICAL SIGNS:

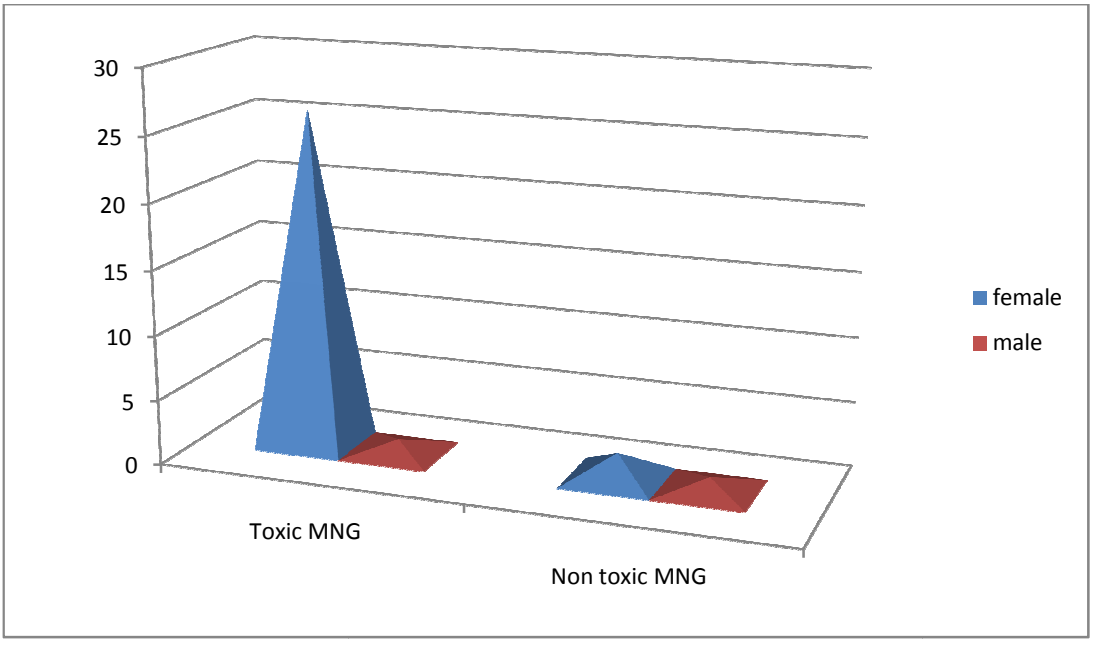
Physical Signs	Number of Cases	Percentage
Mobility with deglutition	30	100%
Left lobe enlargement	4	13%
Right lobe enlargement	4	13%
Both lobe enlargement	22	74%



For 30 swelling moves with deglutition, 4(13%) of them had only right lobe enlarged, 4(13%) of them had left lobe and 22(13%) have both lobes enlarged.

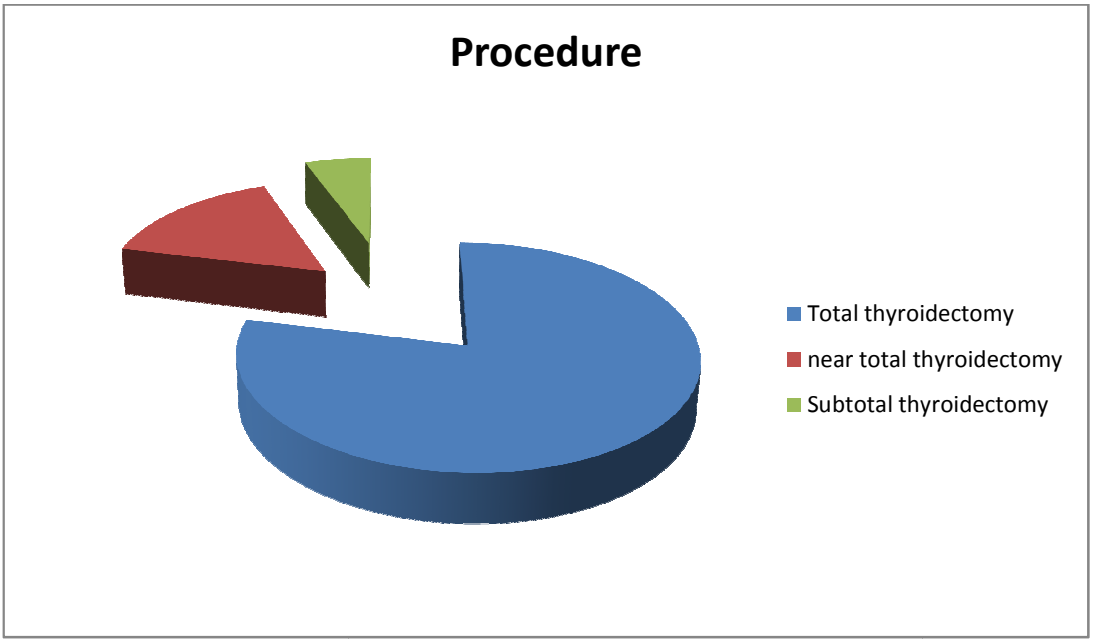
DISTRIBUTION OF SECONDARY THYROTOXICOSIS

Type of goiter	Number of cases	Total	Percentage
Male		**Female**	
Nontoxic multinodular goiter	1	26	90%
Toxic multinodular goiter	1	2	3%



TYPES OF SURGERY DONE:

Type of surgery	No of patients	Percentage %
Total thyroidectomy	20	67%
Near total thyroidectomy	4	13%
Subtotal thyroidectomy	6	20%
Total	**30**	**100%**

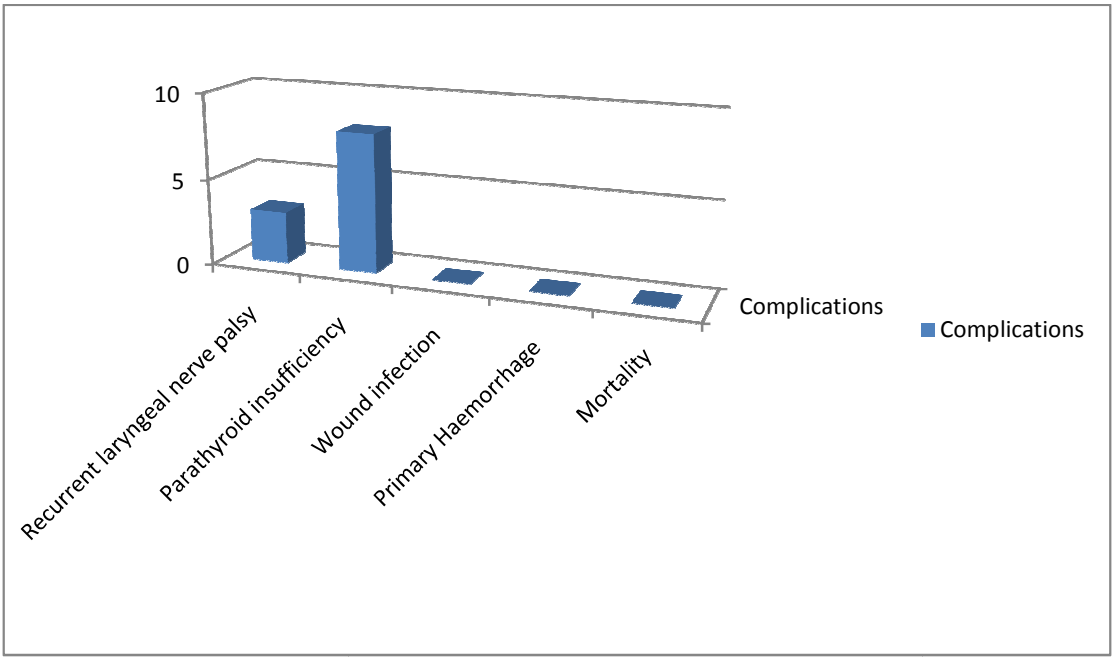


20(67%) of them under went total thyroidectomy, 6(20%) were preceded with subtotal thyroidectomy, and 4(13%) underwent near total thyroidectomy.

POST OPERATIVE COMPLICATIONS:

Type of complications	No. of patients	Percentage %
Recurrent laryngeal nerve palsy (unilateral)	3	10%
Parathyroid insufficiency	8	27%
Wound infection	0	0
Primary Haemorrhage	0	0
Mortality	0	0

21 had nil complications, 8(27%) out of 30 hypocalcaemia for which patients were managed with IV calcium gulconate and oral supplements and 3(10%) had recurrent laryngeal nerve palsy and were managed with steroids, which was also improved on the day course.



Investigations:

Fine needle aspiration cytology was done in all case. Nodular colloid goiter was reported in 23 cases (77%). Hashimoto's thyroiditis was reported in 5 cases (17%). 1 (3%) of the case which was clinically benign and another 1 (3%) was reported as adenomatous nodule in a nodular goiter.

Diagnosis	No. of patients	Percentage %
Nodular colloid goiter	23	77%
Hasimoto's thyroiditis	5	17%
Follicular neoplasm	1	3%
Adenomatous nodule	1	3%

Indirect laryngoscopy was done in all the cases, and one patient was found to have left vocal palsy perioperatively. All other patients were found to be normal.

Thyroid profile was done in all patient and was suggestive of hypothyroidism in 3 cases, 1 had hyperthyroidism and in 26 were found to be normal.

Histopathological analysis vs. FNAC:

According to histopathological analysis in present study of 30 cases, 16cases (53%) showed features of benign colloid goiter, 8 (27%) Hashimoto's thyroiditis in that 4 (50%) were reported as colloid goiter in FNAC. 3(10%) out of 30 had features of both colloid goiter and hashimoto's thyroiditis.

- 1 of the FNAC reported as follicular neoplasm HPE turned out to be adenomatous hyperplasia with hashimoto's thyroiditis.
- 1 FNAC reported as adenomatous nodule in a nodular goiter and reported as minimally invasive follicular neoplasm.
- 1 case was reported as colloid goiter which was finalized as adnomatous goiter with papillary carcinoma in the right lobe.

DISCUSSION

The study which was conducted with aims of assessing clinical presentation, age, sex distribution, Symptomatology indication, complications of surgery and comparison of FNAC with histopathological analysis of 30 cases of MNG admitted to department of general surgery, PSG medical college and hospital. All cases were evaluated clinically and cytologically before the surgery and followed by histopathological analysis.

Age distribution:

According to the study the maximum age presented here was 78 yrs and minimum was 28yrs all 30 patients were screened and most incidences were between the ages 40 to 50 years according to the study.

In the study conducted by Ahuja (65) majority of cases belong to the 3rd and 4th decades. Raja Najum ul Haq (66) conducted a study of 718 more number of case belong to age group 40 to 50 years 261 patients (36.35%). The present study is similar when compared to the above studies.

Sex distribution

It was observed in the current study out of 30 cases 28 were females(i.e. 93%) and 2 were males with a sex ratio of female to male is 14:1. Nygaard B (67) reported that out of 69 cases, 62 cases (89.9%) were females and 7 cases (10%) were males with sex ratio 8.8: 1.

Study by Antonio Alfonso(68) showed a female to male ratio of 7: 1. In the study conducted by Ahuja (65), out of 205 cases 160 (78.1%) were females and 45 (21.9%) were males with a sex ratio of 3.5: 1. With Raja Najum ul Haq(66) female dominance was high 96.80%. In all above studies there is a female preponderance. When compared to the first two above studies was high and third study was almost similar and comparable.

Almost all the thyroid related disorders are common in women and MNG is not an exception, the reason being more TSH fluctuation seen in women during adolescence, pregnancy, child birth and so on.

Symptomatology :

Swelling in front of the neck was how all the patients presented (100 percent). 6 (20%) of them were having constipation, 4 (13%) of them dysphagia, 3(10%) having palpitations, 2(7%) having weight loss, 2(7%) having pain & discomfort, 1(3%) having change in voice and 1(3%) having weight gain.

All patients presented swelling in the front of the neck in that majority of the patient's duration below 1 year was in 11 (36.67%) cases and below 5 years was 14 (47%) cases .In 2 (6.67%) patients presented with duration more than 5 years.

Involvement of both the lobes was seen in majority of patients 22(74%). Predominant right lobe involvement was seen in 4 cases (13%). Left lobe involvement was seen in only 4 (13%) case.

Investigations:

FNAC is considering as the common, cost effective, minimally invasive, low complication, pre operative tool in the evaluation of MNG. Nodular colloid goiter was reported in 23 cases (77%). Hashimoto's thyroiditis was reported in 5 cases (17%). 1 (3%) of the case which was clinically benign and another 1 (3%) was reported as adenomatous nodule in a nodular goiter

Surgical treatment:

All patient took part in the study underwent surgery, total thyroidectomy was carried out in 20(67%) patients, sub-total thyroidectomy was carried out in 6(20%) patients, and 4(13%) patients under went near total thyroidectomy.

Post operative complications:

Out of thirty patients those patients underwent 8(27%) out of 30 hypocalcaemia in that 6 underwent went total thyroidectomy and 2 underwent sub-total thyroidectomy for which patients were managed with IV calcium gluconate and oral supplements and 3(10%) had recurrent laryngeal

nerve palsy all underwent total thyroidectomy and were managed with steroids, which was also improved on the day course.

Histopathology:

In histopathological analysis for the 30 cases was reported as 16cases (53%) showed features of benign colloid goiter, 8 (27%) Hashimoto's thyroiditis. 3(10%) out of 30 had features of both colloid goiter and hashimoto's thyroiditis.

In majority of the cases where the FNAC was benign it proved to be benign MNG on postoperative Histopathological examination. In those 2 cases which was benign by FNAC and HPE was reported as malignancy. One such case reported as follicular neoplasm by FNAC was reported as benign.

A study by Arup Sengupta (69), in the FNAC, preponderance of the cases (75.84%) was colloid goitre followed by granulomatous thyroiditis; follicular carcinoma was noted in 7.30 percent and anaplastic carcinoma in 3.37 percent of cases. Histopathological examination showed benign goitre predominantly (76.97%), followed by follicular carcinoma (8.99%). The overall prevalence of malignancy was 11.24 percent diagnosed by HPE and 9.55 percent by FNAC.

When compared to the above study the results for the FNAC sensitivity is 91% accurate.

CONCLUSION

1. Highest age incidence of multinodular goitre was observed in the age group 41 - 50 years (41%).
2. Females were predominant in number over males with the ratio of 14:1.
3. The commonest complaint was swelling in front of the neck (in 100 percent of cases). Other symptoms were pain and discomfort, dysphagia, palpitation. dyspnoea, increased sweating, increased appetite and weight loss.
4. FNAC was done in all patients which showed 91% sensitivity.
5. The standard surgery done was Total thyroidectomy in 67% cases. Subtotal thyroidectomy in 20% of cases and near total 13% of case.
6. Postoperative period was uneventful in all cases except in 11 cases, in whom 3 patients had unilateral recurrent laryngeal nerve palsy, and 8 patients developed post operative hypocalcemia which also improved on the hospital day course with medications.
7. Though total thyroidectomy was done in 67% case there is no rate of bilateral recurrent laryngeal nerve injury and unilateral injury is also less.

8. The hypocalcemia attack post operatively is 27% percentage which can be prevented by identification of parathyroids while doing thyroid surgery and preserves it.

9. According to histopathological analysis in present study of 30 cases, 16cases (53%) showed features of benign colloid goiter, 8 (27%) Hashimoto's thyroiditis in that 4 (50%) were reported as colloid goiter in FNAC. 3(10%) out of 30 had features of both colloid goiter and hashimoto's thyroiditis. 1 of the FNAC reported as follicular neoplasm HPE turned out to be adenomatous hyperplasia with hashimoto's thyroiditis.1 FNAC reported as adenomatous nodule in a nodular goiter and reported as minimally invasive follicular neoplasm. 1 case was reported as colloid goiter which was finalized as adnomatous goiter with papillary carcinoma in the right lobe.

10. FNAC is an invaluable, minimally invasive highly accurate and cost effective procedure for preoperative assessment of patients with thyroid lesions. Even though follicular neoplasm cannot be differentiated by FNAC.

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PROFORMA

Case No : IP No. : Name : Ward No. : Age : Hospital : Sex : Unit :
Occupation : D.O.A. : Address : D.O.S. : D.O.D. :

CLINICAL DIAGNOSIS:

I. PRESENTING COMPLAINTS

a) Swelling in front of neck

b) Pressure symptoms

c) Symptoms of thyrotoxicosis or hypothyroidism d) other symptoms

II. HISTORY OF PRESENT ILLNESS:

a) Swelling in front of neck :

- Duration
- S ite
- Size
- Onset
- Progression
- Associated pain or discomfort

b) Pressure Symptoms:

- Dyspnoea
- Dysphagia
- Hoarsness of voice
- Voice fatigue

c) Symptoms of thyrotoxicosis or hypothyroidism

- Anxiety
- Fear
- Palpitation
- Precordial pain
- Tremors - Fingers/Tongue
- Sweating - Increased/Decreased
- Weight - Increased/Decreased
- Appetite - Increased/Decreased
- Preference to heat/cold

- Diarrhoea/constipation
- Exhaustion or strain
- Lethargy
- Loss of hair
- Skin changes
- Behavioral changes

d) Other symptoms
- Haemoptysis
- Bony pain
- Persistent headache

III. PAST HISTORY
Irradiation to head and neck in childhood
IV. FAMILY HISTORY V. PERSONAL HISTORY
Diet Appetite Sleep
Bowel and bladder habits
VI. MENSTRUAL HISTORY Flow _____ days
Menoorhagia / amenorrhoea, oligomenorrhea
VII. TREATMENT HISTORY

VIII. GENERAL PHYSICAL EXAMINATION : Pallor	Icterus	Cyanosis
Clubbing	Lymphadenopathy	Oedema

Vital signs :
Pulse _____ Rate Rhythm, Tension, Volume, Character
BP _____ mm of Hg
Respiratory rate _____ cycles / min
Temperature
IX. LOCAL EXAMINATION:

1) Inspection
a) Situation
b) Size
c) Shape
d) Extent
e) Surface
f) Borders
g) Movement with deglutition
h) Skin over the swelling – Colour, Scar, Sinuses
Fungation
Ulceration
i) Visible pulsation j) Visible veins
k) Surrounding area
l) Any secondary changes
2. PALPATION:
a) Local rise of temperature
b) Tenderness
c) Site
d) Shape
e) Extent
f) Sur face
g) Borders
h) Consistency
i) Mobility
j) Plane of the swelling
k) Thrill
l) Carotid pulsation
m) Position of the trachea
3. PERCUSSION :
Sternum - Dull / Resonant
4. AUSCULTATION :
5. MEASUREMENT :
6. TOXIC SIGNS :
Toxic eye signs -

- Fine tremors in fingers/tongue
- Moist skin

X. SYSTEMIC EXAMINATION:
1) RESPIRATORY SYSTEM
2) CARDIO - VASCULAR SYSTEM
3) PER ABDOMINAL EXAMINATION
4) CENTRAL NERVOUS SYSTEM AND REFLEXES
XI. CLINICAL DIAGNOSIS : XII. INVESTIGATIONS :
1) ROUTINE - Hb%: TC:
DC: ESR: Urine -Sugar: Albumin:
Microscopy:
- Blood urea
- Serum creatinine
- Fasting blood sugar
- Blood grouping & typing
- Serum cholesterol
2) SPEICAL - Sleeping pulse rate
- ECG
- X- ray chest
- X- ray neck AP & Lat. views
- FNAC
- Indirect laryngoscopy
- Serum T3, T4 & TSH estimation
- Others
XIII. TREATMENT
1) Medical line of treatment
2) Surgical line of treatment
XIV. HISTOPATHOLOGICAL DIAGNOSIS: XV. POST- OPERATIVE FOLLOW- UP

ANNEXURE – II

CONSENT FORM FOR ANAESTHESIA/ PROCEDURE

I…….. Hosp.no…….. in my full sense hereby give my complete consent for…… or any other procedures deemed fit which is a /and diagnostic procedure /biopsy/transfusion/therapy to be performed on me/my son/my daughter/my ward…… age…..... under any anaesthesia deemed fit. The nature and risks involved in the procedure have been explained to me to my satisfaction. For academic and scientific purpose, the procedure may be televised or photographed.

Signature/thumb impression of the patient/guardian

Date:

Name:

Designation

Guardian relationship:

Full address:

Sl. No.	I.P. No.	Age	Sex	Compln.	Onset	R.O.G.	Symp.	Local examination						Signs of press & toxic	I.D.L	T3,T4/TSH	FNAC	Clinical diagnosis	S Pr
								Move +	Size (cm)	Shape	Surface	SON	Cons.						
1	I13015391	41	F	Swelling	Insd.	Grad	constipario	+	8*5	B.fly	Nod	Both lobe	FM	Nil	N	WNL	HT	Nontoxic	ST
2	I13016809	48	F	Swelling	Insd.	Grd	constipation	+	5x4	B.fly	Nod	Both lobe	FM	Nil	N	WNL	HT	Nontoxic MNG	ST
3	I13013269	28	F	Swelling	Insd.	Grad	Nil	+	4x6	B.fly	Nod	Both. lobe	FM	Nil	N	WNL	FNEO	Nontoxic MNG	T'
4	I13027226	55	F	Swelling	Insd.	Grad	Diff.swall	+	6x4	B.fly	Nod	Both lobe	FM	Nil	N	WNL	NCG	Nontoxic MNG	T'
5	I13015994	43	F	Swelling	Insd.	Grad	Nil	+	4x5	B.fly	Nod	Both lobe	FM	Nil	N	WNL	BCG	MNG	T'
6	I13025318	65	F	Swelling	Insd.	Grad	Nil	+	2x5	B.fly	Nod	Rt. lobe	FM	Nil	N	WNL	CG	Nontoxic MNG	T'
7	I13026114	39	F	Swelling	Insd.	Grad	Pain	+	5x5	B.fly	Nod	Both lobe	FM	Nil	N	WNL	CG	Nontoxic MNG	T'
8	I13021777	78	F	Swelling	Insd.	Grad	Nil	+	8x5	B.fly	Nod	Rt. lobe	FM	Nil	N	WNL	CG	Nontoxic MNG	T'
9	I13016097	47	F	Swelling	Insd.	Grad	Constipat	+	8x5	B.fly	Nod	Both lobe	FM	Nil	N	WNL	CG	Nontoxic MNG	T'
10	I13028595	43	F	Swelling	Insd.	Grad	Nil	+	3x3	B.fly	Nod	Both lobe	FM	Nil	N	WNL	C.LES	MNG	T'
11	I13026094	34	F	Swelling	Insd.	Grad	Change in voice	+	4x5	B.fly	Nod	Both lobe	FM	Nil	N	WNL	CG	Nontoxic MNG	T'
12	I13011913	78	F	Swelling	Insd.	Grad	Diff.swallow	+	8x8	B.fly	Nod	Both lobe	FM	Nil	N	WNL	CG	Nontoxic MNG	T'
13	I13010948	44	F	Swelling	Insd.	Grad	PAIN	+	3x2	Sph	Nod	Left lobe	FM	Nil	N	WNL	BCG	Nontoxic MNG	T'
14	I13007171	45	F	Swelling	Insd.	Grad	Dysp	+	5x7	B.fly	Nod	Both lobe	FM	Nil	N	WNL	NCG	Nontoxic MNG	ST
15	I13005459	52	F	Swelling	Insd.	Grad	Wt.ls	+	4x4	oval	Nod	left lobe	FM	Nil	N	WNL	NCG	Nontoxic MNG	NT

Sl. No.	Ip no.	Age	Sex	Compln.	Onset	R.O.G.	Symp.	Local examination						Signs of press & toxic	I.D.L	T3,T4/ TSH	FNAC	Clinical diagnosis	Sur. Proc	P.O.P	H.P.
								Move + deg.	Size (cm)	Shape	Surface	SON	Cons.								
16	I13029706	37	F	Swelling	Insd.	Grad	Palpitation	+	6x4	B.fly	Nod	Both lobe	FM	Nil	N	WNL	HT	Nontoxic MNG	STT	UNFL	HT
17	I13012553	45	F	Swelling	Insd.	Grad	Nil	+	5x7	B.fly	Nod	Both lobe	FM	Nil	N	WNL	HT	Nontoxic MNG	TT	UNFL	HT
18	I13005421	30	F	Swelling	Insd.	Grad	Palpitation	+	6x7	B.fly	Nod	Both. lobe	FM	Nil	N	WNL	CG	Nontoxic MNG	NTT	UNFL	HT
19	I13036787	31	F	Swelling	Insd.	Grad	Wt.gain	+	11x6	B.fly	Nod	Both lobe	FM	Nil	N	WNL	NCG	Nontoxic MNG	TT	UNFL	NCG HT
20	I13035127	34	F	Swelling	Insd.	Grad	Nil	+	6x3	B.flyl	Nod	Both. lobe	FM	Nil	N	WNL	NCG	Nontoxic MNG	STT	UNFL	NCG HT
21	I13030862	70	F	Swelling	Insd.	Grad	constipation	+	10x7	B.fly	Nod	Both. lobe	FM	Nil	N	WNL	NCG	Toxic MNG	NTT	UNFL	NCG
22	I13024119	41	F	Swelling	Insd.	Grad	Nil	+	4x3	Oval	Nod	Both. lobe	FM	Nil	N	WNL	CG	Recrr .HT	RT	UNFL	HT
23	I13019554	56	F	Swelling	Insd.	Grad	Wt.loss.	+	6x4	B.fly	Nod	Both lobe	FM	Tach +	N		CG	MNG	TT	UNFL	HT
24	I13005411	42	F	Swelling	Insd.	Grad	Nil	+	2x2	oval	Nod	Rt lobe	FM	Nil	N	WNL	Ade.n NG	Nontoxic MNG	NTT	UNFL	NG
25	I13022528	49	F	Swelling	Insd.	Grad	Nil	+	5x3	B.fly	Nod	Both lobe	FM	Nil	N	WNL	CG	Nontoxic MNG	STT	UNFL	NG
26	I13037379	65	F	Swelling	Insd.	Prog	DOE	+	4x5	B.fly	Nod	Both lobe	FM	Nil	N	WNL	CG	Nontoxic MNG	TT	Wound inf.	MNG
27	I13005610	60	F	Swelling	Insd.	Grad	Constipation	+	2x2	B.fly	Nod	Left. lobe	FM	Nil	N	WNL	NCG	Nontoxic MNG	TT	UNFL	NCG
28	I13015994	63	F	Swelling	Insd.	Grad	Nil	+	6x3	b.fly	Nod	Both.Lobe	FM	Nil	N	WNL	BCG	MNG	TT	UNFL	NG
29	I13007359	48	F	Swelling	Insd.	Grad	Nil	+	4x3	B.fly	Nod	Rt. lobe	FM	Tach +	N	WNL	NCG	Toxic MNG	TT	UNFL	NCG
30	I13009629	53	F	Swelling	Insd.	Grad	constipation	+	3x2	B.fly	Nod	Both. lobe	FM	Nil	N	WNL	NCG	Nontoxic MNG	TT	UNFL	NCG

KEY TO MASTER CHART

- App - Appetite
- B.fly - Butterfly
- B/L RLN Pls - Bilateral Recurrent laryngeal palsy
- Bos - Bosselated
- CC - Cystic changes
- Clinic Diag - Clinical diagnosis
- Const - Consistency
- Dysp - Dyspnoea
- Dysph - Dysphagia
- F/M - Female/Male
- Fm - Firm
- FNAC - Fine needle aspiration cytology
- Grad - Gradual
- HPE - Histo-pathological Examination
- HT - Hashimoto's Thyroiditis
- IDL - Indirect Laryngoscopy
- Infn - Infection present
- Insd - Insidious
- Irr - Irregular
- Lt - Left
- MNG - Multi nodular Goitre
- Move+deg - Movement with deglutition
- N - Normal
- NCG - Nodular Colloid Goitre
- NG - Nodular Goitre
- Nod - Nodular

- TT - Total Thyroidectomy
- Palp - Palpitation
- POP - Post-operative Period
- ROG - Rate of Growth
- Rt - Right
- SIFON - Swelling in front of neck
- Signs Of Pres&toxi -Signs of Pressure & Toxicity
- SON - Site of nodule
- St - Soft
- STT - Subtotal Thyroidectomy
- Sur. Proc - Surgical Procedure
- Surf - Surface
- Sw - Sweating
- Syms Of Press & Toxi- Symptoms of pressure and toxicity
- Tachy - Tachycardia
- UNFL - Uneventful
- WNL - Within Normal Limits
- Wt.loss - Weight loss.